

PERSONAL COMPUTING

MAY 1981
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BASIC Too Slow? Compile Your Program
How Operating Systems Help You Use A Computer

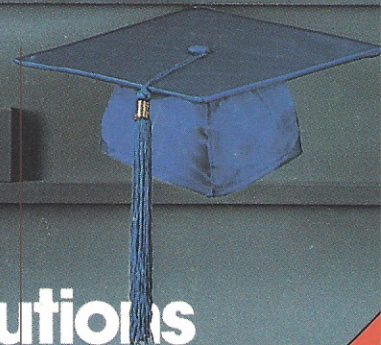
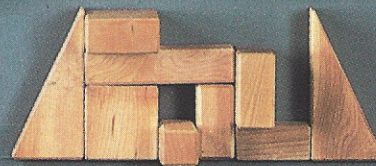
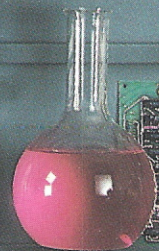
COBOL

PILOT

FORTRAN

BASIC

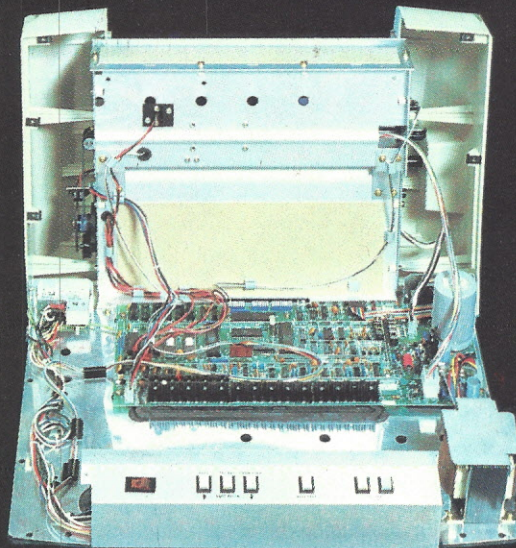
PASCAL



Languages: Different Solutions
For Different Problems

A computer for every need
Special roundup
report on p.45

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CIRCLE 1



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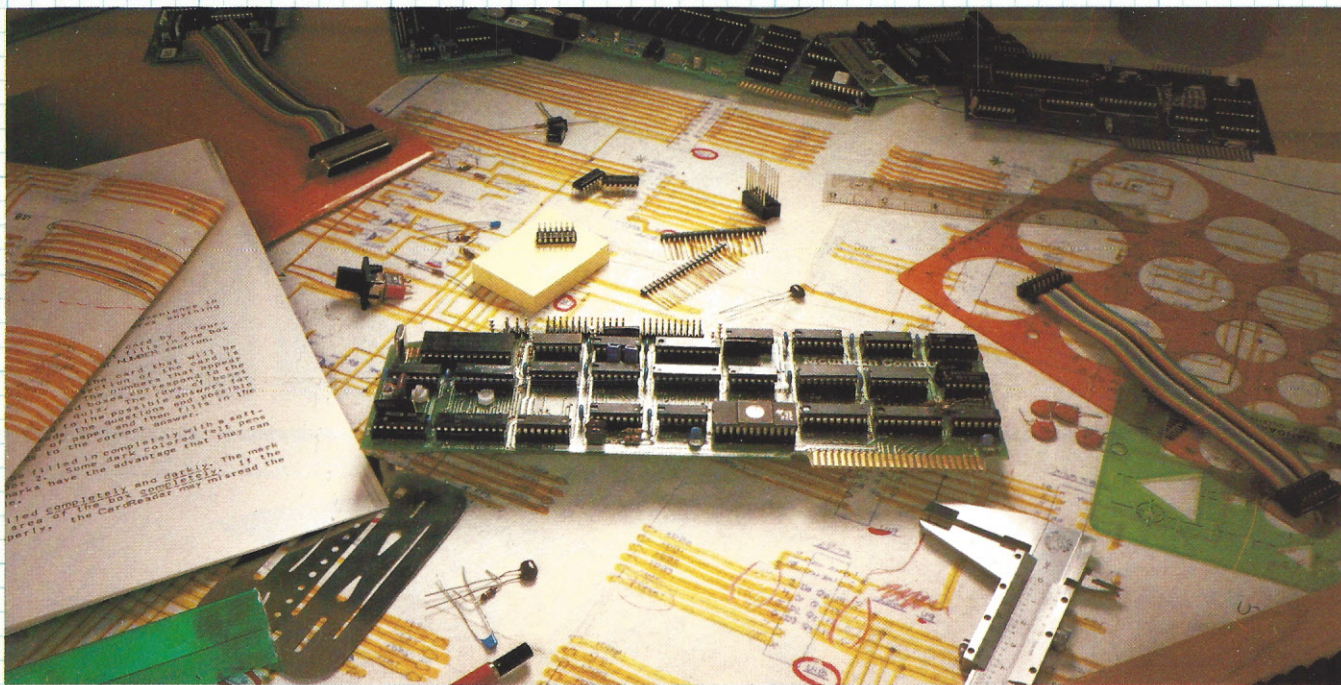
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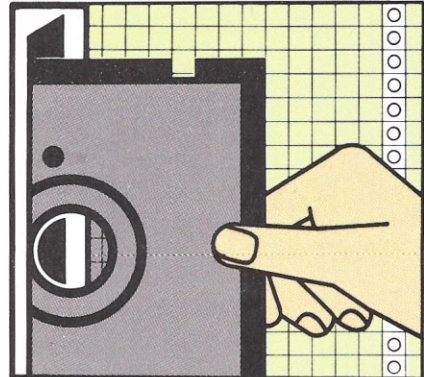
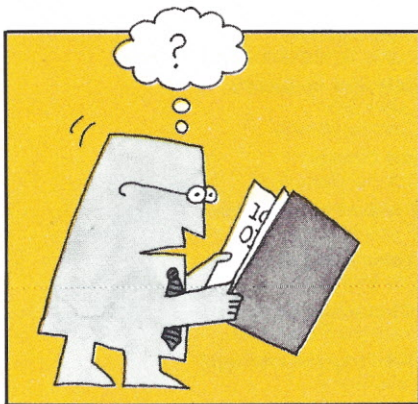
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expect from an interactive
data terminal that costs only
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CIRCLE 3

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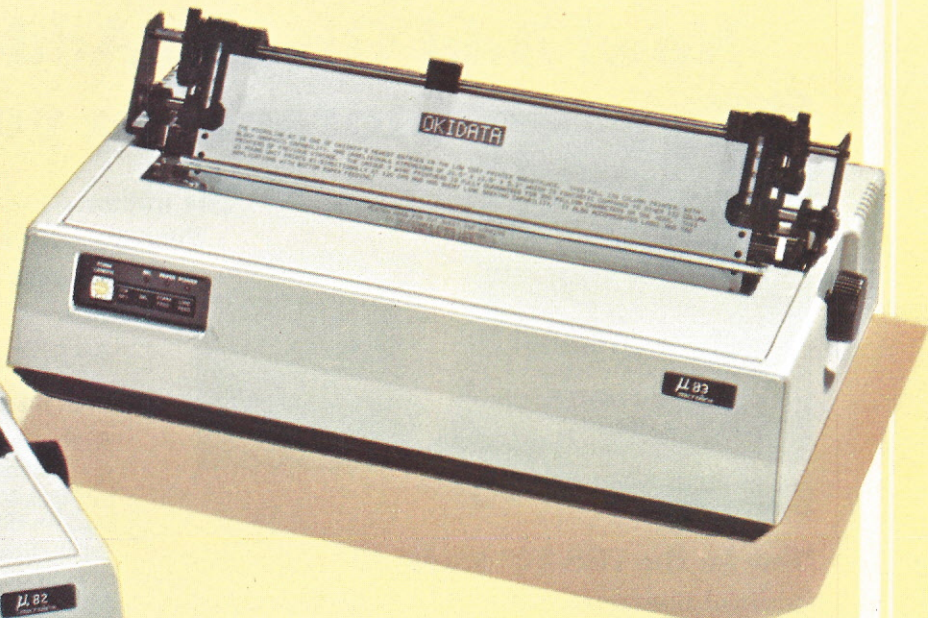
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Small Printers

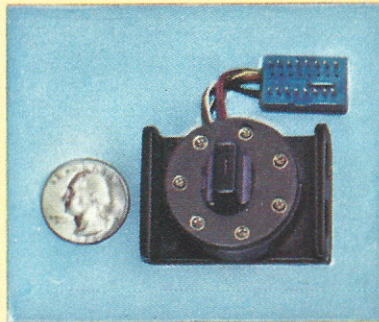


Big Performers

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The Okidata Microline 80 printer set the standards for the home computer market. Now there are two new low cost Microlines for business use that have already won the praise of the most demanding OEMs—the Microline 82 and 83—setting new standards for performance, reliability and flexibility.

Using a tiny, seven-pin head that weighs less than four ounces, the Microline 82 and 83 produce sharp, crisp copy and graphics on plain paper, multipart forms. The unique head is driven bidirection-

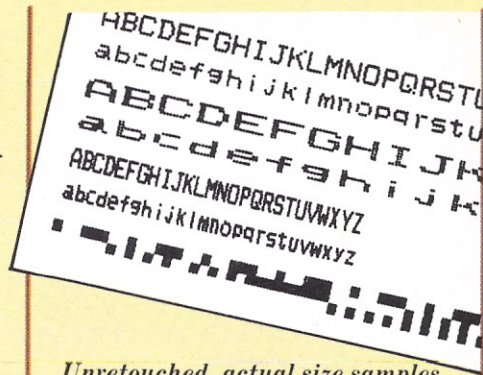


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ally by an elegantly simple mechanism at 80 cps in the Microline 82 and 120 cps in the 83. Short line seeking logic further boosts throughput by 80% over equivalent unidirectional printers.

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- **First Drive Includes DOS:** OS-80™, Percom's fast extendable BASIC-language disk operating system, is included on diskette when you purchase an initial drive kit. Originally called MicroDOS, OS-80 was favorably reviewed in the June 1980 issue of Creative Computing magazine.
- **Works with Model III TRSDOS:** Besides being fully hardware compatible, Percom's Model III 40-track drive systems may be operated with Tandy's Model III TRSDOS — without any modifications whatsoever. And, TRSDOS may be easily upgraded with simple software patches for operating 80-track drives.

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The DOUBLER includes a TRSDOS*-like double-density disk operating system called DBLDOS™.

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And like our Model III drives, Model I add-on drives are optionally available with "flippy" storage capability.

System Requirements:

Model III: 16-Kbyte system (min) and Model III BASIC. The second internal drive may be installed after the first internal drive kit is installed, and external drives #2, #3 and #4 may be added if either an internal or external first-drive kit has been installed. External drives #3 and #4 require an optional interconnecting cable.

Model I: 16-Kbyte system (min), Level II BASIC, Expansion Interface, disk operating system and an interconnecting cable. For double-density storage, a Percom DOUBLER must be installed in the Expansion Interface and DBLDOS (comes with the DOUBLER) or other double-density DOS must be used. For single-density operation, a Percom SEPARATOR™ adapter, installed in the Expansion Interface, will virtually eliminate "CRC ERROR — TRACK LOCKED OUT" read errors. Prices and specifications subject to change without notice.



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Data Base

Dear Editor:

I enjoyed the article on Databases but would like to take serious issue with Mr. Gilder and Mr. Blechman. They lumped some rather sophisticated and powerful DBM systems together with some very simple ones, and dismissed one almost out of hand.

Broken down, almost any business or applications program IS a database. Taken this way, mail lists and bookkeeping systems are databases, unsophisticated, but databases still. So a DBMS, in order to be of any real use, must be written to generate reports for dozens of different uses, with dozens of user-definable fields. This immediately eliminates almost all of the reviewed managers, but not RADEX-10.

In microcomputers, something is, because it is called that thing. Programmers need only have cards printed to use the title. And databases, a magic word from the mainframes, ARE because someone calls them databases. \$50 for a complete DBMS? You can't even buy a module of a bookkeeping system for that! And modules are the point. The power of microcomputers lies in the ability to make them return information the user wants. A DBMS ought to do the same. Why pay for more power than you need? I don't use RADEX-10. I use a more advanced version written by the same author, Ron Lucia, available through C.A.S., P.O. Box 1119, Placentia, CA 92760. It is available for the MODEL I TRS-80 as well as the MODEL II (MODEL II versions run \$149.95 per module). The basic DATABASE module creates, maintains, and prints unsorted reports. All fields are user defined; records, as you noted, can total over 10,000, and files can span disk drives. Pretty darn powerful for under \$100. A SORT

REPORT module has a machine language sort, with up to 31 relational searches and 2 hierarchical sorts, printing reports in 3 formats including mailing labels. A DATA RESTRUCTURE module changes fields without re-entering data, and a SORT DATABASE module does as its name implies. In addition, the database created can be used as the cornerstone of an accounting, job cost, or any other specialized data needs, all available from the author. None (repeat NONE) of the "databases" reviewed comes close. To write this one off because you "have to spend another \$99.50" cheapens the value of quality software. I noticed there was no objection to the \$495 price tag of JINSAM.

Along another line, I offer this axiom: ANY BUSINESS SOFTWARE THAT CAN'T BE BACKED UP ISN'T BUSINESS SOFTWARE. This eliminates many pieces of software from consideration including most of the good programming for APPLE and from PERSONAL SOFTWARE and STONEWARE. If a user can't back up software and data many times as a reasonable protection measure, then the software is without value. Minor electrical glitches, acts of gods, whims of chips can ruin a user's disk faster than a parity error, and, of course, this only happens at critical times. It is nice of them to provide customers with a second disk, but that is hardly enough for "business" needs. Reasonable precautions to protect software are understandable and these include licensing agreements and proper checks on the marketplace. Current problems in Phoenix indicate the problem in piracy may be with the sellers as much as the users. And currently-available software allows backups of many of these "protected" items, anyway, so what is gained? Wasted time and bad P.R.

John Revelle
Rohnert Park, CA

Index Mod

Dear Editor:

The article by C.A. de Zoysa entitled "Program Index for TRS-80 Mini-Disk" in the February 1981 issue of Personal Computing was one I found most useful as I have some trouble remembering the meaning of the eight character Directory names on some fifty disks.

May I suggest one line that will broaden the capability of the program to include machine language programs in DOS recalled by the /CMD suffix. 235 IF RIGHT \$(B\$(A),4) = "/CMD" THEN CMD"I",B\$(A)

I hope that this minor modification to a good program will allow others to enjoy it that much more.

Stephen Carner
Miami, FL

Drugs & Food

Dear Editor:

As a registered pharmacist, I was very pleased to see the article in the February 1981 issue by Rinaldo Prisco entitled "Drug and Food Incompatibilities." I am of the opinion that patients should have as much information as possible about their drug therapy, and this program surely is of value in this regard.

While reading the program, I came across several errors in the DATA statements in the middle of the program which classify the drugs. The corrected statements are given below:

1060 DATA "70 aldomet",
"70 aldoril", "805 anhydron"
1110 DATA "805 diamox",
"40 dicumarol", "780 diupres"
1260 DATA "20 principen",
"10 qidmycin", "30 qidtet"

1300 DATA "90 sinemet",
"805 singoserp", "40 sintrom"

Concerning the author's suggestion about drug/drug incompatibilities, I spent about a year as an undergraduate pharmacy student working on this problem. The programs were written to include such factors as multiple drugs and disease states, age, race and sex of the patient (all are factors influencing possible interactions.) The programs were written and ran correctly, but were never implemented due to the very large data base required for this type of comprehensive system. These programs were written on a PRIME-350 mini-computer with 40 Mb of disk storage, so this problem is probably beyond the capabilities of most micro-computer systems at this time. The programs were set up to print a description and mechanism of the possible interaction. If the user wanted only to indicate interactions without an explanation and limit drug entities to classes instead of specific drugs, the program could be implemented on a microcomputer system.

James W. Bradley III, R.Ph.
Lawrence, MA

StockPak

Dear Editor:

Regarding your March article on the Standard & Poor's StockPak Program, I thought that you might be interested to know that contrary to the author's information, the original production programming for the system was done by Atlantic Analysis Corp., of Norfolk, Virginia. In fact, I wrote the original Report Select program while working for Atlantic Analysis way back in 1979.

The reason that the system takes about half an hour to screen data is that the data is held in string form and the Model I computer "freezes" operation every so often when more than 5,000 characters of string data is

present. Sorting of data is done by a BASIC sort and consequently is very slow compared to a machine sort. Since the idea was to get the programming to run on a 32K Model I, no machine sorts or advanced utilities were used.

Since by the time the end-user receives the stock data disk (with the 900 data records) the data is obsolete, the value of the system is quite laughable from a practical point of view.

Ronald C. Wagener
Computer Generated Data

Menu-Writer

Dear Editor:

This is in reference to the Menu-Writer program in the February 1981 issue of Personal Computing.

Most parts of the program work as it is listed in the article. There is one major flaw in that if one does not wish to use a centering routine the heading will not be assigned to a variable. I fixed it by adding TV\$ = "C\$" to line 1160. I also took the liberty of combining several lines, removing lines 1080 because it did not seem to be doing any good where it was and adding it to the end of line 1495. I also made several other small fixes and changes and added a line or two. All parts of it work now. A listing is enclosed.

A minor nit-pick—the 'IF—THEN' parts of lines 2005—2015 are not really necessary because Applesoft recognizes the POKE 50, . . . commands. There is not any reason for a program to have ragged line numbers when the free renumber program from Apple works so well and so fast.

I am not sure how much I will use the Menu-Writer, but I do find it very interesting. Thank you.

John W. Davison
Ft. Walton Beach, FL

MAY

May 4-7—NATIONAL COMPUTER CONFERENCE; McCormick Place, Chicago, IL; AFIPS, 1815 N. Lynn St., Suite 800, Arlington, VA 22209; (703) 558-3600.

May 4-5—HOW TO PLAN, IMPLEMENT AND MANAGE A WORD PROCESSING SYSTEM; Pace University, Midtown Center, New York, NY; Pace University, Midtown Center, 535 Fifth Ave., New York, NY 10017; (212) 682-5022.

May 21-23—TRS-80 COMPUTER SHOW; Statler Exposition Hall, New York, NY; Kengore Corporation, 3001 Route 27, Franklin Park, NJ 08823; (201) 297-2526.

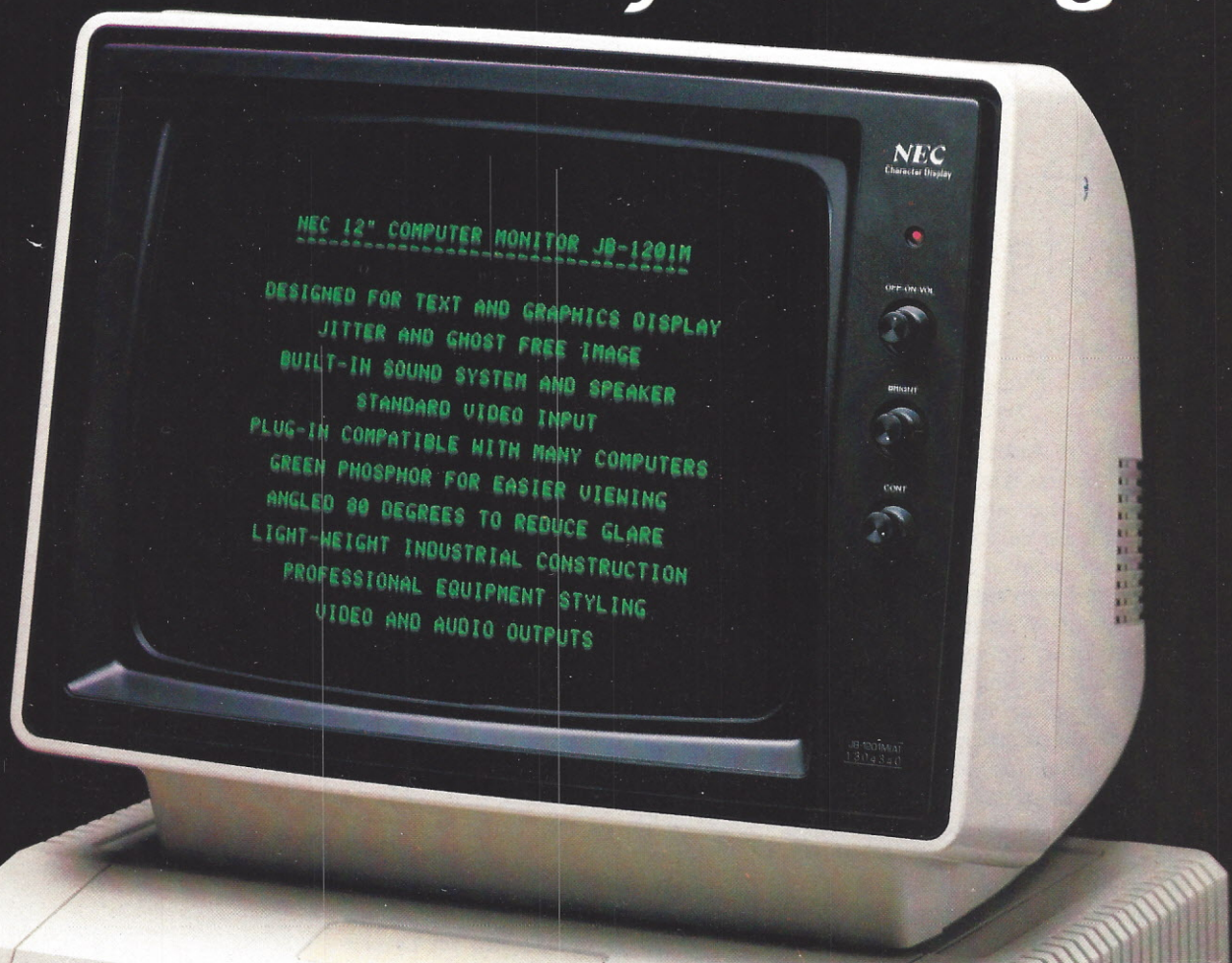
June

June 6-9—THE ATLANTA SMALL COMPUTER SHOW; Atlanta Hilton, Atlanta, GA; The Atlanta Small Computer Show, 4060 Janice Dr., Suite C-1, East Point, GA 30344; (404) 767-9798.

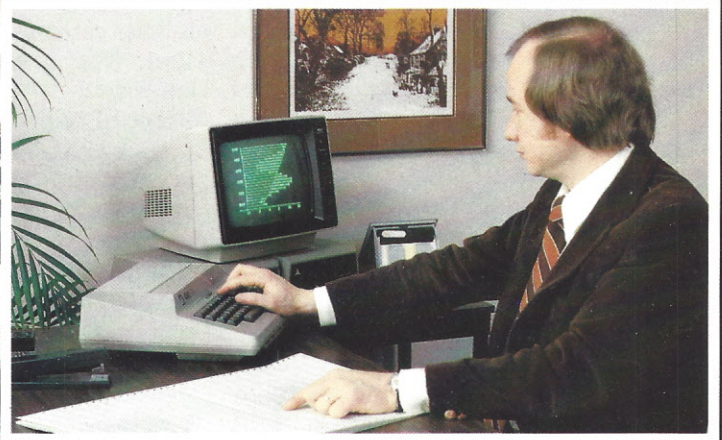
June 22-23—DIGITAL ELECTRONICS FOR INSTRUMENTATION AND AUTOMATION; Virginia Polytechnic Institute and State University; The Department of Chemistry and the Extension Division of Virginia Polytechnic Institute, Blacksburg, VA 24061; (703) 961-5241.

June 23-25—COMDEX SPRING; New York Coliseum, New York, NY; The Interface Group, 160 Speen St., Framingham, MA 01701; (800) 225-4620.

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The Ins and Outs of High-Level Languages

An American making his first trip to Japan would face an enormous obstacle as soon as he left his hotel . . . a language barrier would prevent him from communicating. Without an interpreter or translator, he would have a difficult time finding his way around Tokyo, ordering food, and conversing with shopkeepers.

A personal computer has the same problem, a language barrier, as it attempts to understand and perform for its owner. Computers don't understand English, or Japanese, or French . . . they respond to binary instructions. Humans, on the other hand, face a traumatic experience when they first encounter a multi-page listing of binary numbers; there is simply no meaning or understanding conveyed to them yet the computer comprehends the instructions easily.

The solution. Develop a computer

lish? The answer is that English is not precise enough to meet the rigid demands of a computer; words and instructions must be exact, with no ambiguities. Take the English word court. When it is used, does it mean a yard or alley, or does it mean a court of law, or even perhaps to make love or woo? The English dictionary contains myriad words with multiple meanings; it would be an immense job to train the computer to distinguish which definition to select when a given word is used.

The next best alternative is to develop a language that closely resembles English, can be easily learned by a novice and yet be precise enough so the computer can follow commands without confusion. The result is a high-level language.

Versatility and portability

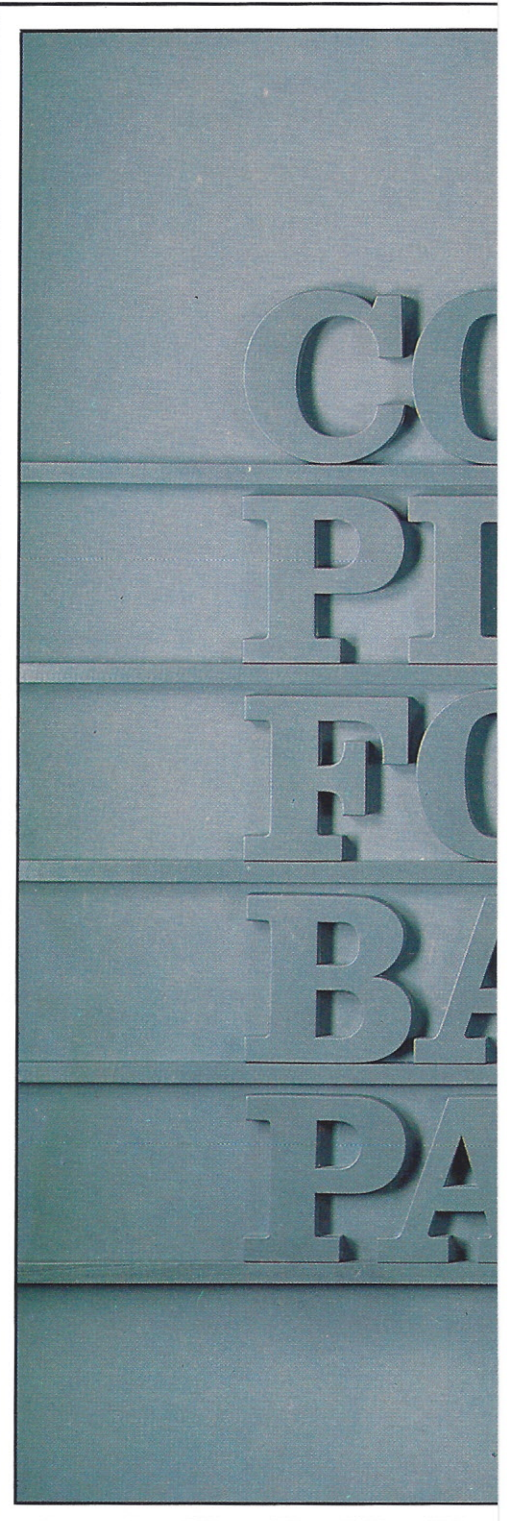
High-level languages are problem-oriented and not developed for any particular computer or hardware. A

English is not precise enough to meet the rigid demands of a computer; words and instructions must be exact, with no ambiguities.

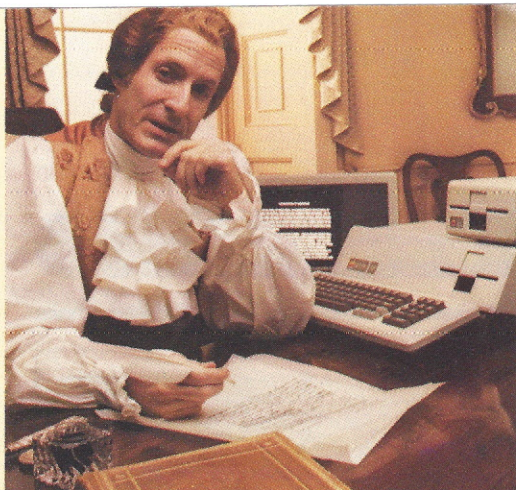
language that can be understood by the user as well as the computer. With an accepted computer language, programs can be written to direct the computer to perform an almost endless number of chores.

How easy it would be to communicate with a computer if it could recognize English. Why not then develop a computer program in Eng-

source program written in a high-level language can be translated into an object program that can be run on any computer; the translator can be either an interpreter or a compiler. Thus if one user were to write a program in a high-level language such as BASIC, he could run it on his particular computer and then travel to another computer location and run







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apple computer inc.

CIRCLE 8



the program, provided the other computer had a similar version of the BASIC translator.

The most popular high-level language for personal computers is BASIC, which appears as a list of brief phrases and symbols. But there is also COBOL, FORTRAN, ALGOL, Pascal, PL/1, PILOT, LISP, Ada and other versions.

High-level languages can be classified as interactive or non-interactive.

With an interactive program, you write the program, and it is executed immediately by an interpreter. You can enter new data or alter the program through direct interface with the computer. In other words, the source code and the object code are the same.

With a noninteractive program, you write the program (the source code), and it is translated by a compiler into another program (the object code) and then run by the computer. In other words, you write the source code, and the compiler generates the object code. To change the object code, you must first alter the source code, then go through the intermediate compiler step.

The interactive program is faster initially, but once all of the bugs are out of a noninteractive program, it is speedier.

Interactive languages include BASIC, APL, Pascal and Ada. Noninteractive languages include FORTRAN, COBOL, ALGOL and PL/1.

High level vs. low level

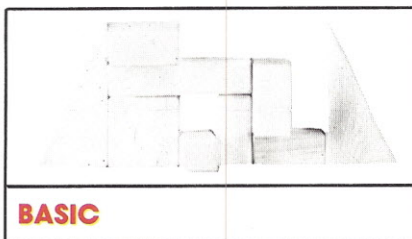
Compared with machine or assembly languages, high-level languages are easier to write, and error location during preparation is simpler. Then why, you may ask, haven't high-level languages replaced low-level languages completely? A high-level language requires more memory space and also takes more time to run in a program, since translation is required to convert the English-like input to binary words. When the computer is small, with limited memory, use of a low-level language may be the only

recourse. Also, the preparation of an interpreter or compiler program for a particular computer can be time-consuming and expensive; a computer manufacturer must invest a considerable sum for such development and count on heavy demand to cover the costs.

If the programmer is experienced, he can prepare machine and assembly programs that will make the computer perform its assignment more rapidly than with high-level languages. Programmers intimately familiar with the detailed inner workings of a computer can tailor more efficient programs in low-level language.

However, as interest in personal computers surges, the number of users without extensive knowledge of programming is increasing, and a high-level language is best suited for their immediate encounter with the computer. Whatever their interest or occupation, there is a high-level language directed to their application, be it science, business, banking, education, process control, engineering or just plain general interest.

Let's examine the more popular high-level languages.



The most popular language used for personal computers today is BASIC (Beginners' All-Purpose

Symbolic Instruction Code), developed in 1965 at Dartmouth College. The National Science Foundation funded the project, which was headed by Professors John Kemeny and Thomas Kurtz. Originally tailored for use on time-sharing computers, the language was intended primarily for teaching computer programming to math and science students.

BASIC is a language directed to the nonprofessional programmer who wishes to use a computer to solve a problem. Features of FORTRAN and ALGOL are included in BASIC—for example, BASIC's use of line numbers and its abrupt shift of program control are similar to steps in FORTRAN.

A major advantage of BASIC, especially to nonprofessional programmers, is the use of an interpreter rather than a compiler. This means anyone can write a program, inspect it, modify it and correct it, when necessary with minimum inconvenience. As each instruction is entered, it is executed, and the computer can immediately locate a syntax error and permit instantaneous correction. BASIC is an interactive language.

A limited vocabulary

It is considered a much simpler language to learn than other high-level languages, such as FORTRAN or COBOL, because it has a relatively limited vocabulary. In one sense, this is a drawback, since BASIC is not a powerful language; simple programs are easy to write, but more complex problems are difficult to handle. For example, most versions of BASIC allow variables to

Universal BASIC commands

ABS	DATA	FOR	INPUT	NEXT	READ	STEP
AND	DEF	FRE	INT	NOT	REM	TAB
ASC	DIM	GET	LET	OR	RESTORE	TAN
ATN	END	GOSUB	LIST	PEEK	RETURN	THEN
CHRS	EXP	GOTO	LOG	POKE	RND	TO
COS	FN	IF	NEW	PRINT	SIN	

Summary of popular high-level languages

NAME OF LANGUAGE	NAME FROM	INVENTED BY/WHEN	ORIGINAL APPLICATION	LATEST VERSION
Ada	Augusta Ada Byron	Defense Dept. initiated in 1975	general	Ada
ALGOL	ALGOritmic Language	international group 1958	science, engineering	ALGOL W, extended ALGOL ALGOL 68
APL	A Programming Language	IBM, Harvard 1960	science, engineering	APLSV
BASIC	Beginner's All-purpose Symbolic Instruction Code	Dartmouth 1965	science	Microsoft Disk BASIC, DEC BASIC PLUS 2
COBOL	COmmon Business-Oriented Language	Defense Dept.	business	COBOL 74
FORTRAN	FORmula TRANslation	IBM 1954-1957	science, engineering	FORTRAN 77
LISP	LISt Processing	MIT 1959	artificial intelligence	LISP 1.6
PL/1	Programming Language 1	IBM 1965	general	PL/1 Optimizer ANSI Standard PL/1
Pascal	Blaise Pascal	Federal Institute of Technology, Switzerland, 1970	general	Standard Pascal

be only one or two characters long, an inconvenience if hundreds of variables are involved. Many programs are available in various versions of BASIC for business, science, education and games.

Here are some of the rules defined in the original version of BASIC: First, a line can include only one statement. Second, each statement must include a line number followed by a key word. Third, statements or instructions will be performed in line number sequence. Fourth, an END statement must conclude each BASIC program.

Most BASIC programs for personal computers today are not as rigid as the original Dartmouth BASIC and will permit multiple statements on a line. In addition the END statement is usually optional.

Although line numbers can be any

positive number from 0 and up, it is good programming practice to use multiples of ten (10, 20, 30, etc.) to allow additional statements to be inserted later. A REM or remark, statement is usually used at the start of a program to inform or remind the user of the program content; the REM statement is nonexecutable and has no effect on the program. Each line is an instruction, and a program is executed by the command RUN. Here is a simple program:

```

10 REM THIS IS A PROGRAM
   TO ADD TWO NUMBERS
20 READ A, B
30 LET X = A + B
40 PRINT X
50 DATA 4, 5
60 END

```

The REM instruction tells the user what the program is. The second

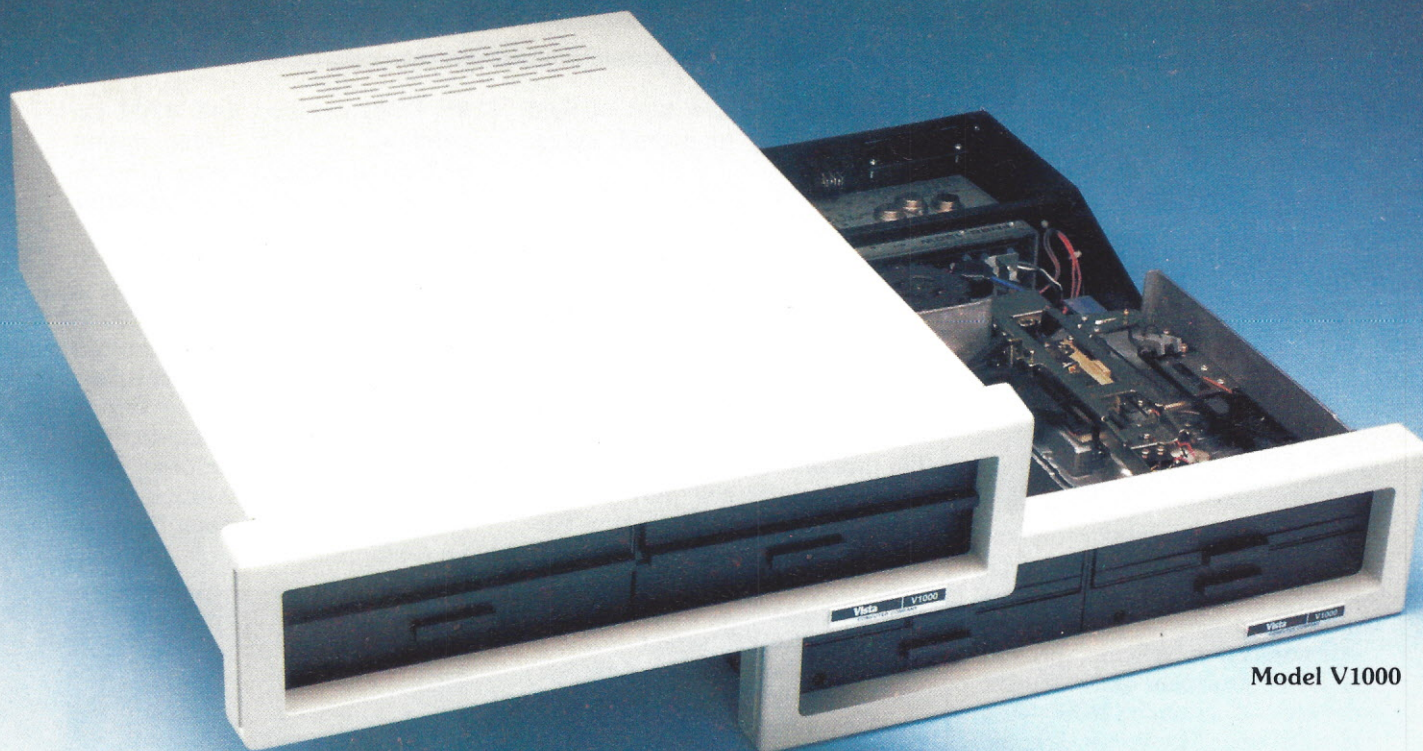
statement—READ, line 20—orders the computer to place in DATA storage, line 50, the information that A is 4 and B is 5. The LET statement, line 30, indicates that the variable X is replaced by A + B or 4 + 5 or 9. Thus, when the line 40 PRINT instruction is reached, the value of X or 9 will be displayed. The simple program is completed by the END statement. The instructions READ, LET and PRINT are key words.

Use of symbols

Most versions of BASIC use the following symbols and relational operators: + for addition, - for subtraction, * for multiplication, / for division, ↑ for exponentiation, < for less than, > for greater than, = for equal to, <> for not equal to, <= for less than or equal to, and >= for greater than or equal

continued on page 67

Vista



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The V1000, Vista's sophisticated new disk drive subsystem, sets new standards for ease of access and use. Its innovative design permits disk drives to be mounted or removed quickly and easily for system reconfiguration or servicing.

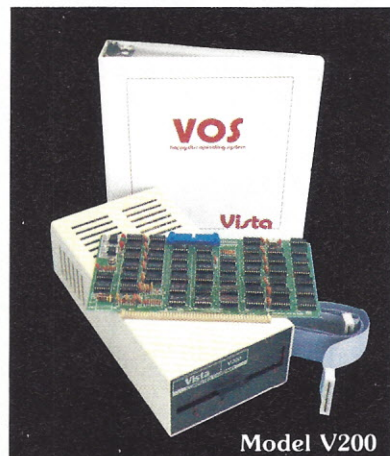
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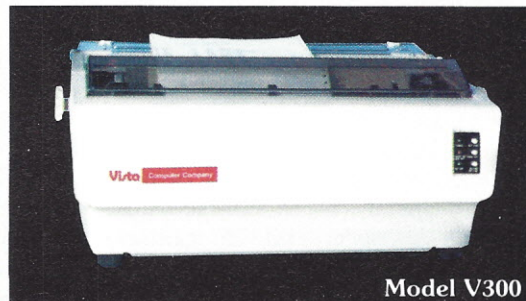
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CIRCLE 7

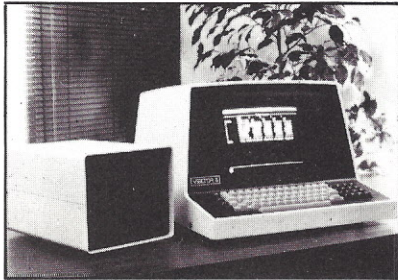
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HARDWARE

SYSTEMS

1.2 MB Storage



A new small business computer system combining high speed, high capacity, high reliability floppy disk storage with a sophisticated error-correction scheme, proven Z80-based processor and extensive software—all at under \$6000—has been introduced by Vector Graphic Inc.

The new system is the Vector 2600. Central unit is a Vector 3 console with 12-inch VDT and keyboard, a Z80-based single-board computer and 64K memory. Mass storage units are dual, double-sided, quad-density, 5¼ inch floppy disks storing a total of 1.2 megabytes.

Like the Vector 3005 system, the 2600 uses the Vector DualMode controller board to interface the floppy disks to the central processor.

Based on IBM-type technology, this DualMode controller board automatically corrects up to five erroneous bits in every 256 bytes transferred from disk to CPU, eliminating errors due to disk contamination, aging, surface defects and all but the most severe disk damage.

In addition to high capacity and automatic error correction, the 2600's floppy disks also provide high speed—three milliseconds, track-to-track, and 75 milliseconds, average access time. Disk

drives feature a new type of rigid design, adding to overall system reliability.

Another DualMode controller feature is 256-byte sector buffering, enabling the 2600 to simultaneously handle interrupts and data transfers in and out of memory for communications tasks and other real-time functions.

Communications and network applications for the 2600 are feasible through its S-100 bus with an RS-232C interface port and its compatibility with all existing Vector Graphic software.

Software provided with the 2600 includes the CP/M2 operating system, SCOPE screen-oriented program editor, RAID debugger, ZSM assembler and Microsoft Basic 80 Release 5.

Options are Peachtree business accounting software, Vector Mem- orite III word processing software (compatible with all common letter-quality printers) and Vector's video calculator for financial planning and modeling.

For more information on the Vector 2600 contact a Vector dealer or Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91362; (213) 991-2302.

Circle No. 101

New Entry

Micro-Expander, Inc. has a new entry into the professional micro-computer market. Called the EXPANDER, the S-100 computer requires only a video display and media storage for operation.

The computer is built around a single board that contains a Z-80A CPU, keyboard circuitry, interrupt, video circuitry, real time clock, parallel printer interface, RS-232 serial interface, and full color circuitry.

Features include standard 80 x 24 screen format, upper/lower case,

4K ROM monitor, 64K RAM expandable to 512K, video output and color graphics using 256 colors, and a complex tone generator with internal speaker.

The EXPANDER functions well as a process control system, a monitoring system, for data communications, or other applications that do not require a video display. It has room, however, for several S-100 boards so the computer can be configured to perform word processing, high resolution color graphics, and numerous business applications.



All CP/M and MP/M software written for the Z-80 will run on the EXPANDER, as well as any other Z-80 operating system. In addition, the computer will run FORTRAN, COBOL, APL, ALGOL, C and other languages that run under CP/M.

The EXPANDER is sold complete with 24K Microsoft BASIC-80 (disk version) and 10K Microsoft BASIC-80 (cassette tape version). Included is "Instant Basic" by Gerald Brown, which serves as a beginner's manual.

The EXPANDER is available at end of May through dealers in the U.S. for under \$2,200. A European version, called PAL, will also be available. For more information, contact Micro-Expander, Inc., 7835 W. Higgins Ave., Chicago, IL 60656; (312) 792-1196.

Circle No. 102

INPUT/OUTPUT

Line Printer V



Radio Shack now offers the new high speed TRS-80 Line Printer V, said to be especially suited to heavy business use. The printer has a bi-directional, logic-seeking dot-matrix head that prints high-quality 7 x 9 upper and lower case characters (with descenders) 132 columns wide. It features software selectable 5, 7.5, 10 or 15 characters per inch, 26 European characters and 30 graphics patterns. Print speed is given as 160 characters per second, 60 lines per minute.

The tractor feed mechanism is adjustable to handle any fanfold computer paper up to 15" wide and up to 5 sheets. It is adjustable in 1/8-line increments for accurate positioning of preprinted forms.

The printer has indicators for Ready, Power and Alert (paper out), plus five pushbutton controls including self-test.

The Radio Shack TRS-80 Line Printer V, available from participating Radio Shack stores and dealers, and Radio Shack Computer Centers, is priced at \$1860. A printer cable is extra. For more information contact Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3272. *Circle No. 103*

Graphics System

Hewlett-Packard's Personal Graphics System, based on the Series 80 personal computer, now incorporates a graphics tablet for easy creation and manipulation of graphics on the display.

Drawing schematics, floor plans, overhead transparencies, and digitizing existing graphics is made simple with the introduction of the software pac for the HP 9111 Graphics Tablet. (The Graphics Tablet, introduced in August, is now compatible with HP Series 80 personal computers.)

The company said software that comes with the HP 9111 Graphics Tablet gives it powerful, easy-to-use capabilities in three main areas: tracing and digitizing existing designs or logos, creating new designs and, measuring areas and lengths of lines directly off maps or charts.

Existing graphics, such as logos, maps, photos, and strip charts may be converted to digital form using the Graphics Tablet. You may analyze digitized data using the HP Series 80 statistics pac and plot out the results on an HP 7225 B Graphics Plotter.



Creating graphics on paper or overhead transparencies for reports or presentations is fast and easy using the system, the firm said. Drawing is as simple as pressing the stylus on the tablet's surface. By selecting commands from the menu included with the software, you can build up a design on the CRT from a library of drawing elements including lines, rectangles and polygons. Changing the scale of a drawing, zooming in on small sections, panning across the drawing and selective erasing are all possible with the menu-driven software. Because no programming is required you can begin solving problems almost immediately.

Another feature of the Graphics Tablet is the Planimeter Software,

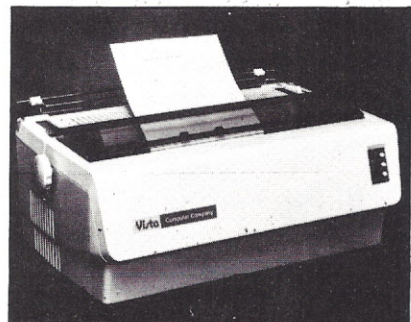
which enables you to precisely measure such parameters as areas, distances, boundary lines and curves with a few presses of the stylus.

The HP 9111 Graphic Tablet has a recommended price of \$2,050 and is available from dealers who sell Hewlett-Packard personal computers. HP Series 80 personal computers have recommended prices of \$2,250 for the HP-83 and \$3,250 for the HP-85. In addition to the computer and tablet, and HP 82901 flexible disk drive (\$2,500) and an HP 7225B Graphics Plotter (\$2,950) may be added to fully utilize all the capabilities of the software. All are available from HP personal computer dealers. For more information contact Inquiries Manager, Hewlett-Packard Company, 1507 Page Mill Rd., Palo Alto, CA 94304; (415) 857-3752. *Circle No. 104*

Daisy Wheel Printers

The V300 Series Daisy Wheel Printers are recent additions to Vista Computer Company's line of peripheral equipment for computer system manufacturers and end users. The series includes 25 characters per second and 45 CPS models. Both models are impact printers which produce letter quality printing using standard Diablo or Qume-type 96-character print wheels. Also, both printers can accommodate paper widths up to 15 inches and can print up to 136 columns. Character spacing is 1/120 inch minimum, and line space is 1/48 inch minimum.

The V300 is furnished complete and ready to use, and offers a



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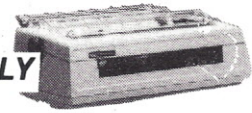
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variety of interface matching capabilities. It is available with either an industry standard Centronics parallel interface or RS232-C. Internal switches can be used to select system operating parameters such as 7- or 8-bit character lengths, single or double stop bits, odd or even parity, and 300, 600, 1200 or 2400 baud transmission speeds. A programmable vertical format unit allows you to select a maximum form length up to 66 lines with top-of-form and VT justification.

Front panel switches are provided on the V300 for power on, select and line feed, and indicators are provided for power on, on-line status, paper out and ribbon out. Either multistrike fabric or carbon film Diablo-type cartridge ribbons may be used.

The V300-25 is priced at \$1,895 and the V300-45 at \$2,195. For additional information contact Vista Computer Co., 1317 E. Edinger Ave., Santa Ana, CA 92705; (714) 953-0523. *Circle No. 105*

COMMUNICATION

Direct Connect Modem




The latest addition to the expanding line of Microconnection modems from the Microperipheral Corporation connects to the Radio Shack TRS-80 Color Computer. It works with a 4K system and extended BASIC is not required. The modem is Bell 103 compatible and operates in both the originate and answer mode at 300 baud.

The Microconnection will interface the Color Computer with the

public telephone networks. It permits accessing other computers and systems such as The Source, MicroNet, public access bulletin boards, or any other time sharing system, the company said. Stand-

ard Radio Shack "Videotex" software can be used.

Several exclusive features incorporated in the Microconnection include a printer interface, and a
continued on page 97

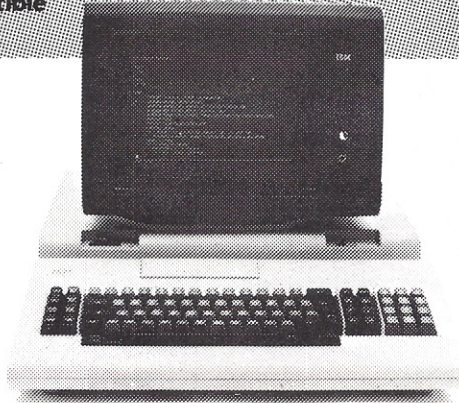


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NEWS

Highlights of the Personal Computing Festival at NCC '81

The Personal Computing Festival, part of the 1981 National Computer Conference, features sessions dealing with the professional and educational uses of the personal computer, busi-

ness applications, and language and technical uses. The site of the conference is McCormick Place in Chicago.

As an important part of NCC, the Personal Computing Festival is designed to show the new dimensions microcom-

puters will bring to an individual's life. Hands-on demonstrations allow conference attendees to test capabilities of hardware and software. This year's keynote speaker is Adam Osborne, author of "Running Wild: The Next Industrial Revolu-

tion." The topic of Osborne's speech is "A New Direction for Personal Computers" in which he discusses the origins of the microcomputer industry and where it is headed.

In his address, Osborne looks at direc-

TUESDAY, MAY 5

9:00 to 10:00 AM

Keynote Session, A New Direction in Personal Computing, Adam Osborne

10:15 to 11:45 AM

Medical and Dental Uses, Paul Hazan, Ellia Neiburger, D.D.S.

Sales Management, Thomas Tighe
CBASIC2, Gordon Eubanks

1:30 to 3:00 PM

University Research and Administration,

Thomas Madron, Melvin Ray

Financial Management Uses, Theodore Needleman,

Caroline Kaufman, David Chereb

PL/1, Gary Kildall

3:15 to 5:15 PM

College Classroom Applications, Robert Judd, Marilyn Jansen

Production Management Use, Daniel Johnson

UCSD Pascal, Carl Helmers

WEDNESDAY, MAY 6

8:30 to 10:00 AM

Educational Uses in Grades K-12, Charlaïne

Charlton, Dorothy Judd, Edwin Herstein

Audio/Visual Communication, Howard Rothman, James Blum

STAR Data Base, Seymour Rubenstein

10:15 to 11:45 AM

Panel Discussion on Teacher Experiences, Dorothy Judd

Conferencing Management, David Stodolsky

XENIX Operating System, Steven Ballmer

1:30 to 3:00 PM

Authoring Systems, Ronald Borta, Donald Coyne
Robotics and Artificial Intelligence, Moderator: Abby Gelles

PEARL—A Data Base Creation, William Stow

3:15 to 4:45 PM

Program Design and Selection, Michael Sloan, Daniel Isaacson, Timothy Smith

Standards and Implementations of Programs, Howard Hollander, Andrew Winston and Gary Koehler

THURSDAY, MAY 7

8:30 to 10:00 AM

Software Sources for Teachers, Lloyd Prentice, M. Dundee Maples, Patrick Moyer, Martin Batey

Programmer Problem Solving, William Lewis

Selector IV Multi-Key Data Base, Mark Robinson

10:15 to 11:45 AM

User Reaction to Software Sources, Robert Judd

PC Graphics, James George, Richard Phillips, Thomas DeFanti

Pascal MT +, Michael Lehman

1:30 to 3:00 PM

Non-Curricular Uses, John Longstreet, Charles Kaufman, J.R. Kilpatrick

Data Acquisition and Display, Richard Fergus, David Carroll

Future of Bar Code Technology, Walter Banks

3:15 to 4:45 PM

Federally Funded Applications, Wilma Jean Alexander, Alfred Fisher

Special Session Panel on Disk Operating Systems, Sol Libes, Moderator

Turn BASIC to Pascal, Peter Worland



Atari graphics and sound stand in a class by themselves."

David D. Thornburg
Compute Magazine, November/December 1980

"Its superiority lies in three areas: drawing fancy pictures (in color), playing music, and printing English characters onto the screen. Though the Apple can do all these things, Atari does them better."

Russell Walter
"Underground
Guide to Buying a
Computer"
Published 1980,
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CIRCLE 11

"The Atari machine is the most extraordinary computer graphics box ever made..."

Ted Nelson
Creative Computing Magazine, June 1980

"...so well packaged that it is the first personal computer I've used that I'm willing to set up in the living room."

Ken Skier, OnComputing, Inc. Summer 1980

"...well constructed, sleekly designed and user-friendly—expect reliable equipment, and strong maintenance and software support."

Videoplay
December, 1980



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tions that the personal computer industry is likely to take. He notes that we must discount much that has been said about the industry in the past and a great deal of what is being said about it today. "We have no reason to believe that today's observers and critics are any better informed than yesterday's," says Osborne. In projecting the effect microcomputers will have on the office, Osborne says, "The low cost of new microcomputer products coupled to their great efficiency will strip away the last defenses of white collar workers, forcing them to adapt or change their professions." Osborne also thinks that "the difference between those who fall in line and learn to work with this new technology will be so great, as compared to those who work in traditional ways, that the traditional workers will soon be faced with the option of learning to use microcomputers themselves, or seeing their careers disappear into obscurity."

Coinciding with Osborne's theme of new directions for the personal computing industry are the three main areas of discussion in the Personal Computing Festival: professional and educational uses, business applications, and languages and technical uses. There are 30 sessions including panel discussions and paper presentations, and 22 noncommercial demonstrations of the uses of

personal computers. The festival includes a "hands-on" game room and a video theater on microcomputer history and applications.

Among the sessions included in the Professional and Educational Uses section, which would be of particular interest to doctors, dentists, and teachers, are the many uses of computers in the medical and educational fields. Sessions on the uses of microcomputers in the dental office and as aids to the handicapped are featured as part of the medical focus. College classroom applications, university research and administration, teacher experiences, program design and selection, software sources for teachers, federally funded applications and educational uses in grades K-12, are highlighted in the education area.

In the Business Applications section, sessions on sales management, financial management, production management, audio-visual communication, conferencing management, programmer problem solving, graphics, disk operating systems, and data acquisition and display are presented. There is also a two-session panel discussion on robotics and artificial intelligence chaired by Abby Gelles of the Robotics Institute of Carnegie Mellon University. Members of the panel include David Ahl, Ernest Kent, David Thornburg, W. Robert Hudgins, Norbert Tagge,

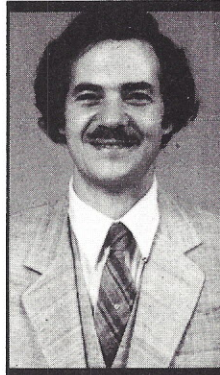
David Jasper and Steven Long.

The Languages and Technical Uses section features sessions on CBASIC 2, PL/1, UCSD Pascal, STAR Data Base, the XENIX operating system, PEARL, the future of Bar Code technology, standards and implementations of programs, Selector IV and others.

Other sessions

In addition to the technical sessions presented as part of NCC's Personal Computing

Leon Levy of Bell Laboratories offers a session called "Programming Languages for Small Systems" on Monday, May 4. He has assembled a panel of language developers, users, and persons who have worked extensively with a particular language, to discuss the problems associated with small system languages and their possibilities for the future. Panelists include: Deane Blazie, president of Maryland Computer Services, a



In his keynote address at the Personal Computing Festival, Adam Osborne discusses the change in office structure. "The low cost of new microcomputer products coupled to their great efficiency will strip away the last defenses of white collar workers, forcing them to adapt or change their professions."

Festival, several sessions in the main NCC program should be of interest to personal computer users. The subjects of these sessions are:

- Software
- Education and Societal Issues
- Automating the Office And Computers at Work
- Hardware and Architecture
- Network Technology and Capacity and Performance Analysis
- Information Processing Management
- Data Base Systems and Computers at Work
- Visuals, Natural Language Processing and Artificial Intelligence.

small systems house that deals mainly with BASIC for business and data processing software; Richard Cicelli, an editor of the Pascal Newsletter who has been active in the Pascal standardization effort; David Fisher, who has been directly involved in the Ada language development effort; Narain Gehani from Bell Labs who has done comparative studies on different programming languages; David Robson of Xerox, one of the developers of the Small Talk language; and Elizabeth Rather, vice president of Forth Incorporated. Each panelist makes a five-minute position statement and

then fields questions from the audience.

Another session dealing with languages is "Pascal: Standardization and Extension" led by A. Winsor Brown. According to Brown, the objective of this program is to inform the public about the current status of the Pascal standardization and extension effort from a historical, political and technical viewpoint. One paper at this session deals with a survey of currently implemented Pascal extensions. The panel consists of four members of the Pascal Standards Committee who discuss the standardization and extension effort both on the national and international level.

Also dealing with computer languages but in the area of automating the office and computers at work is a session led by Robert J. McGlinn and Lowell Carmony called "Choosing a Computer Language for a First Problem-Solving Course." The first of four presentations in this session is by James W. Graham of the University of Waterloo titled "If BASIC then Waterloo BASIC". Anne Miller Millman from Michigan Technological University discusses a pedagogical approach to Pascal which she researched as the result of an Apple Education Grant. The third speaker, Herman Hughes from Michigan State University, discusses A Structured Programming Language (ASPL) which he advocates for use by

beginners. The last speaker is slated to be Lowell Carmony who will talk about ELAN, a language that is fairly well known in Germany. "It is modern and structured like Pascal but is easier to learn," he claims.

A panel discussion titled "Effects of Computers on Personal Life" takes place Tuesday, May 5, led by Abbe Mowshowitz. The three major topics in this session are learning, community, and individuality. The section dealing with learning is led by Beau Sheil of Xerox. It focuses on problems that people have in understanding computers, and the implication of computers from the point of view of the growing importance of computers in people's lives and the need for them to understand these basic ideas. The second session on effects of computers on personal life in the community, is led by Andrew Clement of the Computer Science Department of the University of Toronto. He looks into grass roots initiative experiments (making computers available for community use) which could change the power structure in the world of high technology. Robert Ellis Smith, editor and publisher of a privacy journal presents the third section on individuality. Smith is concerned with the effect of computers on personal privacy and the relationship between individuals and government and other organiza-

continued on page 61

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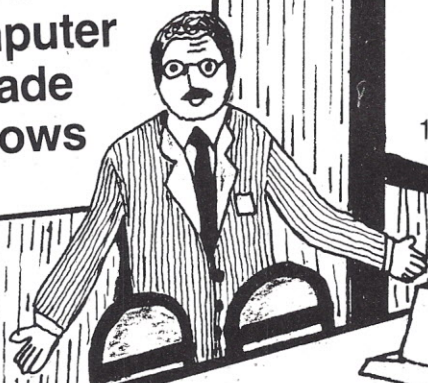
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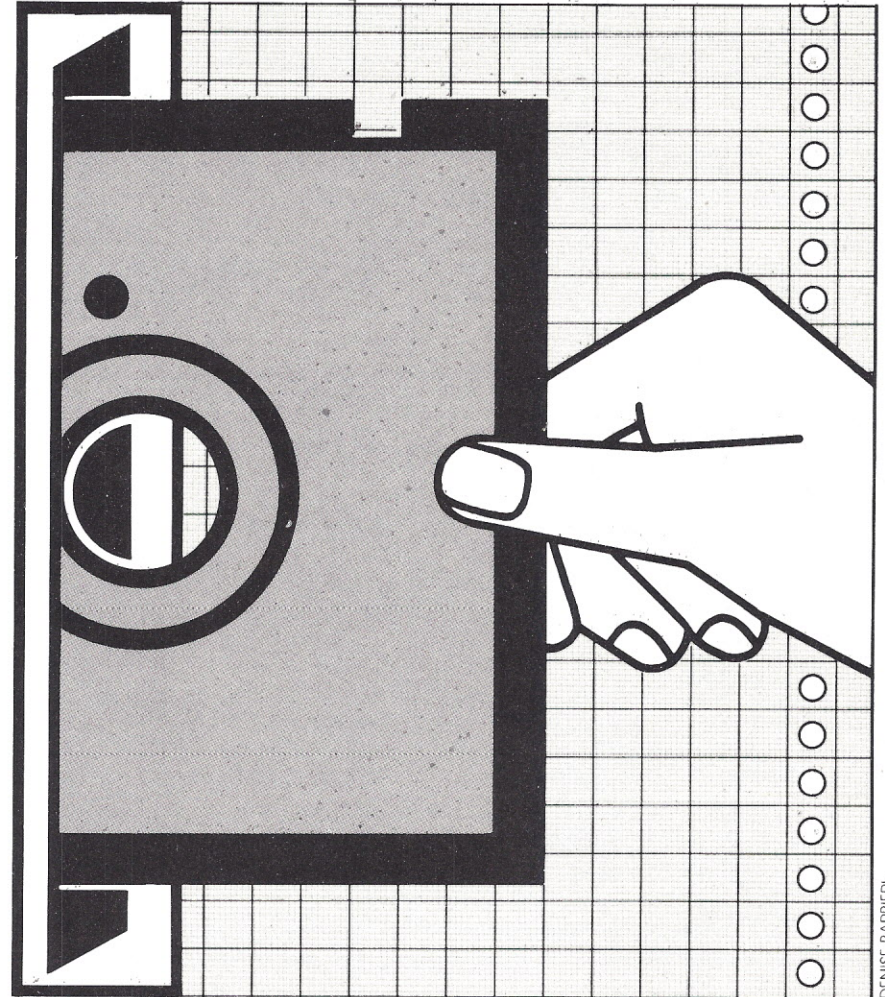
A User's Guide To Operating Systems

Think of an operating system as a computer's "housekeeper." It does a lot of chores that the user might otherwise have to do. With computers as complex as they have become—including microcomputers—an operating system is a necessity to get the full use of the computer. A look at some basics shows why.

Nothing happens inside a computer unless it is supplied with instructions. And every computer must have a program in it that can understand those commands. In the early days of personal computers, this program was called a Monitor. Sometimes it was entered with front-panel switches. More fortunate people had a shorter program, called a bootstrap loader, to enter the Monitor.

As new storage devices became available at lower prices, the Monitor program assumed more responsibilities that allowed the entering of programs from a keyboard, the transferring of memory contents to a printer, the loading and saving of programs on cassette, and the searching of tape for a requested program. At the same time that Monitor programs were being expanded and improved, assemblers, debuggers and editor programs were being developed for microcomputers. When all of these "housekeeping" programs were organized and combined, the first operating system was born.

An operating system is a structure of software that, in a sense, disguises the hardware involved. Thus a user working with a CP/M operating system need not be concerned with the specifics of his machine. Once the CP/M program is loaded into his mi-



crocomputer, whatever application program he wishes to use will be compatible with the CP/M operating system, not with the hardware. An operating system like CP/M enables almost any microcomputer to operate with any software.

A versatile workhorse

Today a great many of the functions performed by an operating system are taken for granted: job entry,

device interface, input-output control, disk file management and resource allocation. Users are content that somehow a turn of the key or a press on the start button provides enough information to enable the computer to talk with them.

Actually the process moves in stages. The turn of the key enables the computer to read the first few instructions of the operating system

Company	Operating System	Computer/Microprocessor	Price	Applications
Altos Computer Systems 2360 Bering Drive San Jose, CA 95131 <i>Circle No. 200</i>	AMEX	Altos 800 Series/Z80	\$600	small business
Apparat Inc. 4401 S. Tamarac Pkwy. Denver, CO 80237 <i>Circle No. 201</i>	NEWDOS NEWDOS + NEWDOS 80	TRS-80/Z80 TRS-80/Z80 TRS-80/Z80	\$ 49.95 \$ 99.95 \$149.95	general purpose, small business general purpose, small business general purpose, small business
Apple Computer Co., Inc. 10260 Bandley Dr. Cupertino, CA 95014 <i>Circle No. 202</i>	Apple DOS Language System SOS	Apple II/6502 Apple II/6502 Apple /// /6502B	\$280.00 \$495.00 \$250.00	general purpose, small business general purpose, development system, process control, small business
CGRS Microtech, Inc. P.O. Box 102 Langhorn, PA 19047 <i>Circle No. 203</i>	CRS/FDOS CRS-PDOS	SYM, AIM/6502 PET/6502	\$ 75.00 \$ 75.00	general purpose, development system general purpose, small business, educational
Cromemco Inc. 280 Bernardo Ave. Mountain View, CA 94043 <i>Circle No. 204</i>	CDOS CROMIX	All Cromemco Systems/Z80A All Cromemco Systems/Z80A	\$ 95.00 \$295.00	general purpose general purpose
Digital Research P.O. Box 579 Pacific Grove, CA 93950 <i>Circle No. 205</i>	CP/M MP/M CP/Net	8080/Z80 8080/Z80 8080/8085/Z80	\$170.00 \$300.00 \$200.00	general purpose, development system, small business general purpose, development system, small business, process control general purpose, development system, process control, small business
Electrolabs P.O. Box 6721 Stanford, CA 94305 <i>Circle No. 206</i>	OS-1	280	\$250.00	general purpose, small business
Heath Benton Harbor, MI 49022 <i>Circle No. 207</i>	HT-11 HDOS	Heath-11 H-8, H-89 8080/Z80	\$350.00	general purpose, development system, small business general purpose
Lobo Drives Int'l 354 South Fairview Ave. Goleta, CA 93117 <i>Circle No. 208</i>	LDOS	TRS-80/Z80	\$139.00	general purpose, small business

stored permanently in a read-only memory. These instructions, part of a bootstrap loader, contain sufficient information to "bootstrap" in the remainder of the system. Suddenly the computer is able to understand information coming from the keyboard, the printer, the disk drives and other peripheral devices. Other "linkage loaders" permit the computer to read in, enter and execute other programmed instructions or software.

Let's examine the versatility that an operating system adds to the computer:

● INPUT/OUTPUT CONTROL.

In the early days of applications programming, each programmer was responsible for handling all the details of data acquisition. To read information from a magnetic tape device, one had to ensure that the device was available and operating correctly, that the tape or disk was moving to

arrive at the read head at the correct speed, and that the right information was under the read head when the reading took place. Today all such details are the responsibility of the input/output control portion of the operating system.

● DEVICE INDEPENDENCE.

Most programs are now written in what is termed a higher-order language, such as BASIC, FORTRAN or COBOL. With these, you can ask

Company	Operating System	Computer/Microprocessor	Price	Applications
Microsoft 10800 NE 8th St. Bellevue, WA 98004 <i>Circle No. 209</i>	XENIX	8086/Z8000/68000	Contact vendor	general purpose, development system
Microware Systems Corp. 5835 Grand Ave. Des Moines, IA 50304 <i>Circle No. 210</i>	OS-9 Level 1 OS-9 Level 2	6809 6809	\$195.00 \$495.00	general purpose general purpose
NorthStar Computers 14440 Catalina St. San Leandro, CA 94577 <i>Circle No. 211</i>	NS/DOS NS/HDOS	Horizon +, 2Q, 2D/Z80A Horizon, HD-18/Z80A	with hardware with hardware	general purpose general purpose
Ohio Scientific Inc. 1333 S. Chillicothe Rd. Aurora, OH 44202 <i>Circle No. 212</i>	OS-65D OS-65U OS-Pascal	C1, 2, 3 series/6502 C3 series/6502 C2, C3 series/6502	\$ 79.00 \$990.00 \$450.00	general purpose, process control, small business small business general purpose, process control, small business
Percom Data Corp. 211 N. Kirby Garland, TX 75042 <i>Circle No. 213</i>	OS-80 (DBLDOS) MPX/ MINIDOS	TRS-80 Mod I, III/Z80 All systems using Percom Data's LFD disk/6800	\$ 30.00 \$ 70.00	general purpose, small business, personal general purpose, development system, process control
Phase One System Inc. 7700 Edgewater Dr. Suite 830 Oakland, CA 94621 <i>Circle No. 214</i>	OASIS-single user multiuser	Z80/Z8000/8086 California Computer Systems' 250, 300, 400	\$150.00 \$350.00	general purpose, development system general purpose, development system
Smoke Signal Broadcasting 31336 Via Collinas Westlake Village, CA 91362 <i>Circle No. 215</i>	DOS68 FLEX-09 BOS	Any using 6880/6809 Any using 6809 Any using 6809	\$ 75.00 \$150.00 \$750.00	general purpose, development system, small business general purpose, process control, small business general purpose, small business
SofTech Microsystems 9494 Black Mountain Rd. San Diego, CA 92126 <i>Circle No. 216</i>	UCSD P-System	Most microcomputers	Contact vendor	general purpose, development system, process control, small business, education
Technical Systems Consultants Box 2570 West Lafayette, IN 47960 <i>Circle No. 217</i>	FLEX UniFLEX	6800/6809 6809/68000	\$150.00 \$450.00-\$800	general purpose, development system, small business general purpose, development system, small business

the computer to WRITE or PRINT without worrying about whether the printing will be done on the dot-matrix printer you now own or the NEC Sprinwriter you hope to own tomorrow. You can write such device independent programs because of the device interfacing done by the operating system.

● **DISK FILE MANAGEMENT.** Most of a personal computer's random-access memory (RAM) is

volatile, and its contents will disappear when the computer is turned off. To avoid loss, files and programs must be stored in an external mass storage device. Every time a program is executed or a file accessed, it must be loaded from the tape or floppy disk on which it is stored into the computer's memory. This operation is performed automatically by the linkage loaders and file management portions of an operating system.

While some personal computer owners still use cassettes for data storage and retrieval, most have switched to floppy disks. The advantages are speed and random access. Instead of having to reel through minutes of unwanted material on a cassette, you can go directly to a desired file on a disk. The operating system will create and maintain a directory for each device, each volume (disk or tape) and each file, without

need for user intervention.,

● **SPOOLING.** The microprocessor inside a microcomputer, whether a Z80 chip or a 6502 or a 6800, is every bit as fast as the processors inside mainframe computers. But the microcomputer's input/output devices are considerably slower. All computers must reconcile the speed of the microprocessor with the slowness of peripheral devices. It is up to the operating system to "spool" information from an input device to main memory, to auxiliary storage and back again. The best operating systems allow the spooling to take place at a relatively slow speed, while the microprocessor continues to work at a relatively fast pace on other tasks.

● **HIGH-LEVEL LANGUAGES.** One measure of the excellence of an operating system is its ability to support the user's choice of high-level languages. Naturally a system that supports many different languages will be more useful than one that supports only one language. In addition some operating systems permit files in one language to be accessed by other languages. This is a most useful feature.

It's important that a user be able to learn and use the commands and features of an operating system without excessive study of the system's inner workings. A system that is easy to use is spoken of as being "friendly," a quality that is highly prized by users.

But the more friendly systems may be beyond the capacity of a particular microcomputer because of their size or complexity. The ability of a computer to run a friendly operating system is often a factor in the selection of the machine. Another factor is the amount of software that has been written to run under control of an operating system—and its portability from one machine to another.

Originally all personal computers were designed for a single user one disk system and one set of dedicated peripherals. Now there are multi-user systems, so several users can share the same computer and disk systems. Each user has a "partition" of memory in which to operate. The operating system must not only sup-

port the several users, but also allocate the system resources among them. Some multi-user systems even allow each user to run more than one task at the same time. To accomplish this, both the computer hardware and the operating system must be much more complex.

In the beginning. . .

The development of operating systems really started when floppy disks began to be used with microcomputers. MITS Altair was probably the first company to offer a working floppy disk system, but the company didn't have a disk operating system. It used the operating commands of Disk Basic, written by Microsoft. Then along came the Midwest Scientific Co. to offer the first floppy disk operating system for its M6800 disk system. This operating system was also the first to offer a bootstrap program in ROM and an effective method for making copies with only one disk drive. And Midwest also offered a version for the 8080 microprocessor.

Other companies that offered early floppy disk systems were Imsai and Ohio Scientific. The Imsai system suffered from lack of an operating system, but the Ohio Scientific system used the first primitive version of OS-65, an operating system that worked but did not have a directory. The user kept track of the locations of his files on the disk by writing the locations on a piece of paper.

The Icom company offered its Fugal Floppy system for microcomputers, and this was the first floppy disk system for the S-100 bus that was priced within the range of many hobbyists. The same company also developed an operating system called FDOS, which lacked many advanced features but had a good file management system. The development of the minifloppy by Shugart Associates provided the greatest impetus to the adoption of floppy disks for personal computers. The low cost, ease of interface and size made the minifloppy a natural enhancement to the microcomputer.

Among the first to adopt the minifloppy was the North Star Computer

Co. It offered a disk controller for S-100 computers using either 8080 or Z-80 microprocessors and either one of two drives. In addition the buyer received free North Star BASIC and a small but efficient North Star DOS. Within a short time the North Star disk system became very popular. It offered owners of Processor Technology SOL's, Polymorphic Poly 88s and TDL Z80 systems a low-cost, reliable disk system. In addition Imsai owners who wanted minifloppy disk also bought North Star, because Imsai did not make a minifloppy system at that time.

The most popular of the microcomputers was the improved Altair 8080B. While this system did not include a separate disk operating system, it used Microsoft's Disk Basic both as an operating system and as a high-level language. The disk system was activated (or booted) by a disk PROM bootstrap loader. After being bootstrapped, the BASIC system would take over and ask for the following: Memory Size, Highest Disk Number, How Many Files? and Random Files to open at one time. After this exchange, Disk BASIC would take over, and all the system commands would be given in BASIC. The PIP utility program for performing such tasks as printing directories, initializing disks and copying disks was also in BASIC.

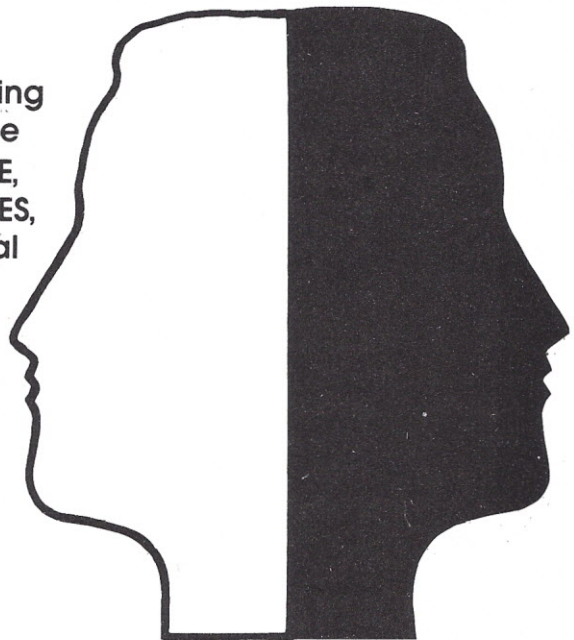
The Altair disk system provided a foundation for the first practical business applications software, and many such systems are still in use today.

The coming of CP/M

The 8080 microprocessor was developed by Intel as an improvement over the earlier 8008 microprocessor, and a development computer system designated the MDS was designed to enable users to develop applications using the 8080. The MDS included disks, and a disk operating system was designed by Gary Kildall of Digital Research. This operating system was called Control Program/Microprocessor, or CP/M, and it was designed to be used with any 8080 or Z-80 disk system, with some custom installation by the manufacturer of

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the disk system and by the user.

The first S-100 disk system to install CP/M as an operating system was made by Digital Systems Corp., and it proved to be very popular. In a short time both Cromemco and Imbsai adopted versions of CP/M, and it became a de facto standard for 8-inch 8080 and Z-80 disk systems. One factor that helped the popularity of CP/M was the formation of the CP/M Users Group, which distributed software that had been contributed by users. The group distributed this software to members for the cost of the diskette. Another factor was the decision by Digital Research to sell its product for the lowest possible price and to make money on volume. For a little over \$100, a user got the software disk plus six manuals covering "Installation," "Use," "The Editor," "The Assembler" and "The Dynamic Debugger." The price is a little higher these days for a version that has been adapted for most microcomputers, but it is still one of the great bargains of the industry.

In addition Basic-E, CBASIC and Microsoft BASIC were all available on CP/M, and within a short time versions of COBOL and FORTRAN got on the bandwagon.

The large group of users who owned North Star systems with mini-floppies became the next large group to turn to CP/M when Larry Alcock, founder with Tony Gold of a company called Lifeboat Associates, adapted the system for the 5 1/4-inch disks. Lifeboat Associates initial goal was to install CP/M on the widest possible range of computers and to sell all kinds of utility and applications software that would run on CP/M. Today the company has put CP/M on every 8080, Z-80 and 8085 computer system made, and the list is growing.

What CP/M can do

Much of CP/M's activity, like that of any good operating system, takes place behind the scenes. A look at Digital Research's system shows that CP/M is responsible for contacts between the computer and its attached

devices, like the video screen and the printer. CP/M is also responsible for file management.

Disk files are seldom stored as a single continuous record. Files are scattered about the disk in chunks to take full advantage of the disk drive's speed of access. CP/M provides for linkages between successive records in a given file. The operating system creates and maintains a directory for each device, each volume (disk or tape) and each file; it does this automatically.

CP/M also permits the user to access a disk drive or a printer directly. Many microcomputer owners use this operating system when they use a canned software package like a word processor or a general ledger routine. For example, Magic Wand, a word processor developed by Small Business Applications, makes intensive use of CP/M. Magic Wand can work with five disk files simultaneously, reading one, inserting another, displaying a third, spooling a fourth to the printer and writing to a fifth. This "magic" ability stems from the use of CP/M commands to access and create disk files, rename them and write (spool) either to the video terminal or the printer.

The most obvious CP/M commands are also the easiest to use. By simultaneously depressing the CTRL key and one of the letter keys, the user can restart the system, start or stop other operations, or erase a line or a character, depending on the letter command employed.

By using the CP/M commands DIR or STAT, the user can display a disk's contents file by file. The "x" can take the place of a specific file name, so that the command STAT x.x will produce a list of all the files on a disk, the amount of space occupied by each, and the amount of space remaining on the disk. A directory of letter files only can be obtained if the command DIR x.LET is specified. Letters may be designated

by the recipient—say, the ABCD corporation, and the date, say 29/9, so that ABCD29/9.LET would be the name of a typical letter file. The CP/M command DIR ABCD??/??. The suffix .LET may be used to request a full listing of correspondence with ABCD.

Extras with CP/M

CP/M consists of two portions: a resident system that must always be present in memory and an optional, or transient, portion that resides on a disk until summoned. The reason for the division is to conserve memory; obviously memory occupied by an operating system is memory that is not available for other tasks.

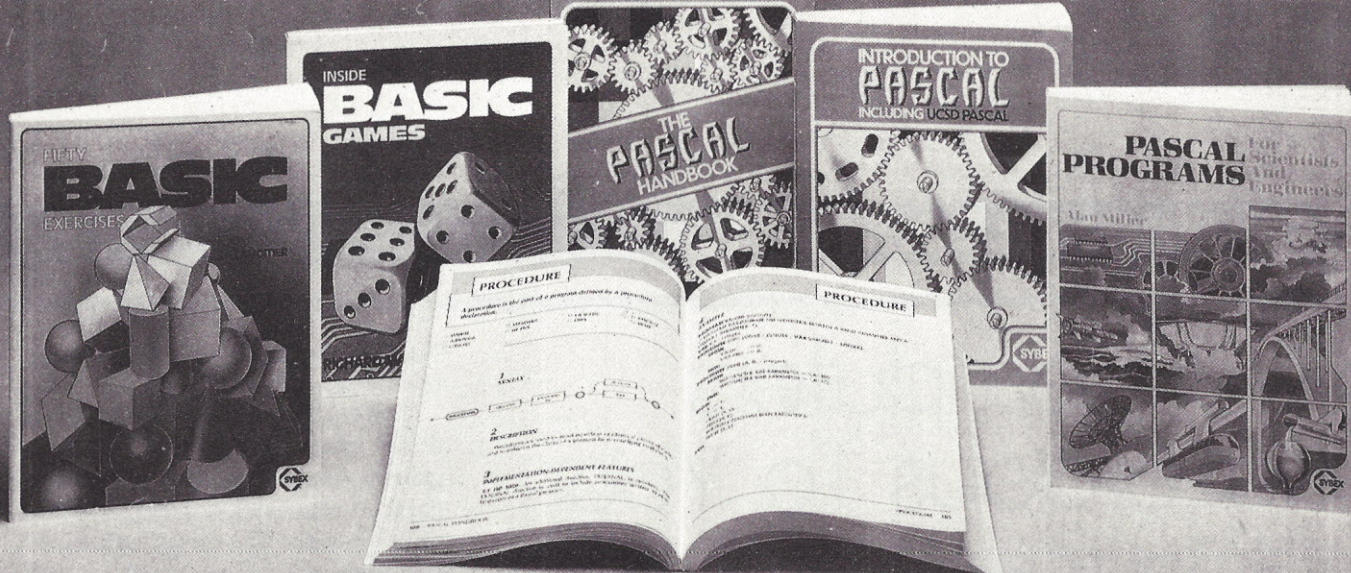
CP/M's nonresident portion includes a utility, PIP, for copying files from one disk to another; ASM, an 8080 assembler program, and DDT, a dynamic debugging trace utility. These utilities can prove invaluable in the development of programs—and, remember, programmers cost more than microcomputers.

The dynamic debugging trace utility DDT is excellent—its manual is about the best that CP/M has to offer, containing a lengthy, worked-through example of how to use the trace utility. PIP provides a comprehensive set of routines for copying files from one device to another. It is too slow for copying a complete disk, and users might want to consider purchasing the Software Store's DISK-UTIL for this purpose. CP/M's ASM program should be replaced in its entirety if you own a Z-80 based processor.

CP/M's drawbacks

The chief drawback of CP/M is its intolerance of mistakes, and its lack of good diagnostics and error messages. Should one attempt to write to a read-only file, CP/M doesn't merely caution "no, no, no," but it also signs off abruptly. The same is also true with a dozen other disk read/write errors. Even TRSDOS is

continued on page 83



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Are Computers Hazardous To Your Child's Health?

With personal computers becoming widely used in schools, one question that is frequently asked is: Is it really a good idea for these kids to be sitting just a foot or so from a TV or monitor screen? What about those warnings a few years ago about radiation from TV sets?

Many teachers and parents, are concerned about the long-range effects on children (and adults) of prolonged use of color and even black-and-white cathode-ray tube mon-

itors. Let's see just how serious the problem is, if indeed there is a problem, and whether there are safety guidelines that schools and parents could be following to protect children against any hazards. Safety of computer equipment is an area fraught with controversy, where the specialists have not been able to resolve the basic issues and where competing interest groups cite totally opposite facts and figures.

Effects are unclear

The biological effects of low-level radiation are not clearly understood.

Neither are other possible dangers from video monitors.

There are two areas of concern about video screens. The first is a general one about all the possible harmful effects of X-radiation. The second is a specific concern about vision problems: fatigue, eyestrain and possible eye damage.

The level of awareness in schools to possible dangers from video screens appears to be low but growing. Some administrators admit that the issue has never been raised by any teachers involved in microcomputer projects in their districts. Others note that they have comments, which were usually provoked by news reports about video terminals in the workplace. In the last year, the frequency of teacher and parent comments on the hazards of video screens appears to have been increasing.

Newspaper reporters, librarians, airline reservation clerks and other workers who use video display terminals have been among those most concerned about possible radiation hazards. Obviously there's a real difference between these people, who spend up to seven hours each working day for years in front of a video screen and children in schools. At present few children spend even an hour a day at a computer. However, if all predictions are correct, they will one day be spending significant portions of their school day with computers, and they'll use them from elementary school through college. Concern will probably continue to grow as the novelty wears off and as publicity about possible hazards increases.

In the area of X-radiation, the source is the high-voltage electron beam that strikes the phosphors inside the front of the picture tube to produce the picture. In the process some slight X-radiation can be given off. The higher the voltage, the high-

ESTIMATED AVERAGE ANNUAL RADIATION DOSES IN MILLIREMS

NATURAL SOURCES

Cosmic radiation near sea level	23
at 5000 feet	50
air travelers	65
plane crews	160
Radioactive constituents of body	28
Gamma rays from terrestrial sources	26

ARTIFICIAL SOURCES

Medical and dental X-ray	20
Radioactive pharmaceuticals	2-4
Nuclear power	1
Laboratories	0.2
Industrial applications	0.01
Fallout from atomic tests	4-5
Consumer products	4-5

Source: Report of the Committee on Biological Effects of Ionizing Radiations, 1979

er the X-rays produced. This means that color TV sets produce more radiation than black-and-white sets, because the color sets have higher voltage. It was when color TV sets were first produced that safety warnings were issued and recommendations made to sit back six feet from the screen. Over the years, as more sensitive phosphors have been developed, lower voltages have been needed and the potential radiation has dropped. Larger screens also require high voltage and produce more radiation.

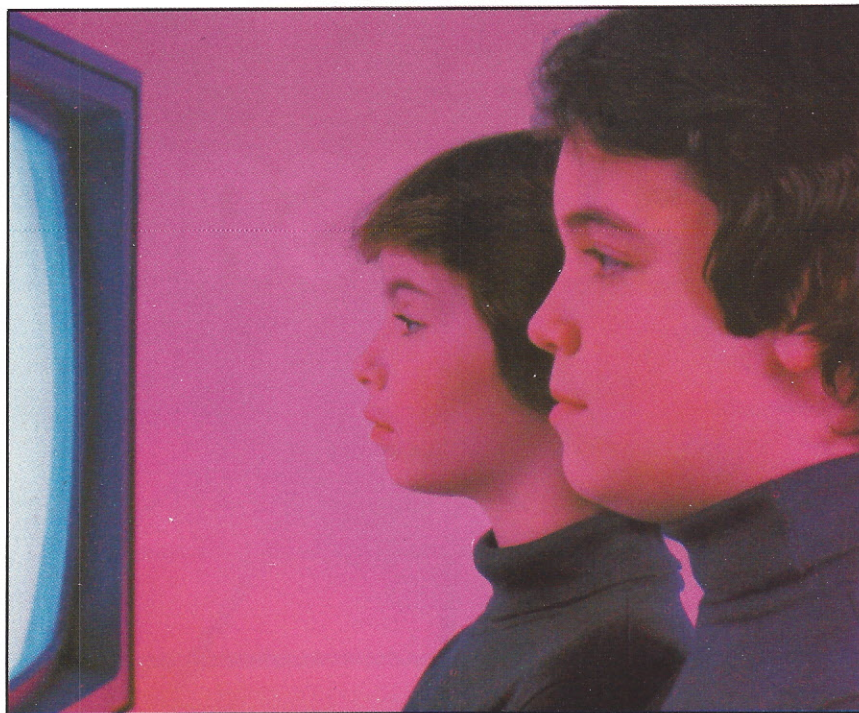
Just how much radiation are we talking about? In 1968 the Federal Government set standards for the maximum allowable radiation that could be emitted from a TV set when the picture tube voltage was 15,000 volts or more. So a look at these standards gives us a place to start.

The Government requires that the TV set not give off more than 0.5 milliroentgen per hour at a distance of 5 centimeters from any point on the surface. If through a malfunction the voltage increases, the picture must go blank.

Now it turns out that a *roentgen*, which is a measure of the amount of electromagnetic radiation (X-rays and gamma rays), is related to that *rem* we all became familiar with during the Three Mile Island crisis. The rem is used to measure human exposure to electromagnetic radiation; it stands for roentgen equivalent man. A rem is the amount of radiation producing the same biological effect as one roentgen of high-penetration X-rays. So the Government standard of 0.5 milliroentgen can be roughly considered as equivalent to 0.5 millirem, although the biological effect of radiation can be affected by various factors.

Radiation not great

No one, not even kids who appear to sit with their noses on the TV screen, sits 5 cm from the screen. A distance of 20 to 50 cm is typical.



KENNETH W. SCHROEDERS

That would mean a maximum exposure of from 0.03 down to 0.005 millirem per hour. (The intensity varies inversely with the square of the distance.) There would be less radiation from a set with less than the maximum allowable radiation. Assume that a child uses a color TV or color computer monitor at a distance of 30 cm (about 1 foot) an average of an hour a day either in school or at home. (We won't count exposure from watching TV at home for three hours or more a day.) The maximum radiation received by this hypothetical child would be 3.65 millirems per year (0.01 per day).

It turns out that the amount of radiation we're talking about here is not much. A chest X-ray (which was used as a comparison to calm us during the Three Mile Island crisis) gives a dose of 250 millirems. Therefore a chest X-ray is about 68 times stronger than the total effect of our one year's hypothetical radiation from video monitors in school. An-

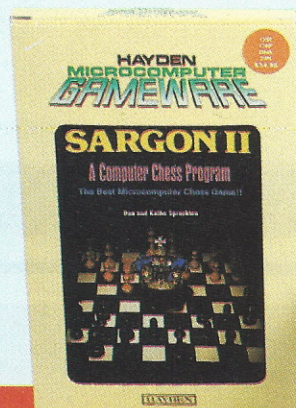
other comparison: The allowable exposure for radiation technicians is 5000 millirem a year.

For more perspective, consider that we live in what has been called a constant crossfire of ionizing radiation. The average American receives 100 millirems a year from natural sources--cosmic radiation, internal radiation (from our own bodies) and radiation from soil and rock. The table shows these totals of radiation. Obviously the radiation one gets from the computer monitor is very slight compared with other sources.

Unknown low-level effects

So it seems we have nothing to worry about, right? Unfortunately this is where we encounter controversy. There is no real agreement on the effects of long-term low-level radiation. Some experts want to reduce allowable exposure levels to one-tenth what they are now. A British study has found chromosome damage in 200 workers exposed to

continued on page 95



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REVERSAL (Spracklens) Winner of the software division of the First International Man-Machine OTHELLO™ Tournament, this version of the 200 year old game Reversi, features 27 levels of play and high-resolution color graphics and sound. Special "Kibitz" option gives you hints in playing. Written by the authors of SARGON II, the first great computer chess program! **07004, Apple II tape, \$29.95; 07009, Apple II disk, \$34.95.**

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| <input type="checkbox"/> 01204 | <input type="checkbox"/> 02401 | <input type="checkbox"/> 02803 | <input type="checkbox"/> 03404 | <input type="checkbox"/> 03504 | <input type="checkbox"/> 04513 | <input type="checkbox"/> 05203 | <input type="checkbox"/> 05609 | <input type="checkbox"/> 07301 | |
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SARGON II (Spracklen) The Champ of champs. "...an excellent program which will provide a true challenge for many players... Save your money and buy SARGON II..." **'80 Software Critique. 03403, TRS-80 Level II; 03404, Apple II; 03410, OSI C1P; 03440, OSI C4P; each tape \$29.95. 03408, TRS-80 Level II Disk; 03409, Apple II Disk; 03414, OSI C1P Disk; 03444, OSI C4P Disk; 03484, C8P Disk; each \$34.95**

BLACKJACK MASTER: A Simulator/Tutor/Game (Wazaney) A serious game that performs complex simulations and evaluations of playing and betting strategies. **05303, TRS-80 Level II tape, \$24.95; 05308, TRS-80 Disk Version, \$29.95**

MICROSAIL (Johnson) A true test of your nautical skills as you race against wind, tides, and time. **04401, PET tape, \$11.95**

GRIDIRON: A Microfootball Game (Microflair Associates) Be both offensive and defensive quarterbacks. Includes time-outs, penalties, and the two-point conversion option used in college football. **03003, TRS-80 Level II tape, \$12.95**

MAYDAY (Breitenbach) Out of fuel! Try to avoid crashing with this challenging airplane flight simulation. **02601, PET tape, \$9.95**

STARCLASH (Walton) An exciting game of galactic strategy for one or two players. **05903, TRS-80 Level II tape, \$16.95**

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BACKGAMMON (Wazaney) A classic game of skill and luck played against a preprogrammed opponent. **02501, PET; 02503, TRS-80 Level II; each tape, \$10.95**

BATTER UP!!: A Microbaseball Game (Savon) Action-packed baseball with 3 levels of play. **02801, PET; 02803, TRS-80 Level II; each tape, \$10.95**

BUSINESS

★ ★ **HISTO-GRAPH** (Boyd) A calendar-based histogram or bar-graph production system. Allows the user to enter numeric data that relates to a date, and reproduces that data as a high-resolution histogram. **09009, Apple II Disk, \$29.95**

FINPLAN: A Financial Planning Program for Small Businesses (Montgomery) Allows you to enter data from a balance sheet into the program, to make assumptions about the future growth of business, and to have the computer project results for up to a five year period based on those assumptions. And if you change any data, the program revises all resulting data automatically. The disk version can be used only with TRSDOS Version 2.3. **05103, TRS-80 Level II tape, \$69.95; 05108, TRS-80 Level II Disk Version, \$74.95**

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★ ★ Denotes New Program

DATA MANAGER: A Data Base Management System and Mailing List (Lutus) Store information on a floppy disk, and retrieve it quickly and easily by specific names, or by category. **04909, Apple II Disk Version, \$49.95.**

MAILING LIST (Tru-Data Software) Lists addresses, prints labels, allows for alterations and deletions, and has the capacity to make duplicate data file disks. Can only be used with version 1.5.
05713, Heath Disk \$49.95

UTILITY

LINE & VARIABLE CROSS REFERENCE GENERATOR (Johnson) Provides a cross-reference of line numbers and variable names.
07301, PET tape, \$16.95

APPLESOFT UTILITY PROGRAMS (Gilder) Increase your BASIC programming speed and flexibility. Contains 9 useful subroutines: 1. REM Writer 2. PRINT Writer 3. POKE Writer 4. Hexadecimal/Decimal Converter 5. Line Counter 6. Renumber 7. Append 8. Byte Counter 9. Slow List/Stop List
03504, Apple II tape, \$29.95

RENUMBER & APPEND: Utility Programs for the Apple (Gilder) Renumber your Applesoft program and append a second program to the one in memory.
03804, Apple II tape, \$14.95

REVIVE (Gilder) When a program is accidentally erased, REVIVE searches through memory and finds the information that enables it to restore the pointers that have been changed. **03604, Apple II tape, \$19.95**

SLOW LIST/STOP LIST: Utility Programs for the Apple (Gilder) Start, stop, and control the speed of your program with Apple II's game paddles. **03904, Apple II tape, \$10.95**

PSEUDODISK (Neuschatz) This money-saving program simulates a disk memory system for Integer BASIC programs. It allows multiple programs in memory at the same time which can be run from a catalog. **04804, APPLE II tape, \$24.95**

6502 DISASSEMBLER (Stamm) Produce assembly language source files with labeled subroutines and references from programs already in memory. It is compatible with Hayden's ASSEMBLY LANGUAGE DEVELOPMENT SYSTEM.
08609, APPLE II Disk, \$39.95

DISK CERTIFIER AND COPIER (Jacc Inc.) A handy utility program that certifies the acceptability of blank diskettes and rejects those with flaws. It also includes a fast machine language disk copying program that will work on single and dual drive systems. **07809, APPLE II Disk, \$19.95**

DISK CATALOGER (LeBar) Automatically maintains a cross-reference listing of all your programs, their location by disk number, their function and use. Catalogs, lists and sorts programs. **05203, TRS-80 Level II Disk, \$16.95; 05208, TRS-80 Level II Disk, \$21.95**

LANGUAGE

PROGRAMMING IN APPLE II BASIC: Self-Teaching Software (Banks & Coan) Teach yourself Apple II BASIC and control your own progress at all times with this interactive programmed instruction format. **05004, Apple II, tape, \$29.95; 05009, Apple II Disk Version, \$39.95**

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SUPER APPLE II BASIC (Lutus) A structured BASIC that compiles into an optimized Applesoft or Integer BASIC program. **05409, Apple II Disk, \$39.95**

Super FORTH (Bugbee) This is a fast, high-level, expandable language that features integer and floating-point math, high-resolution graphics and string handling capability. **05509, APPLE II Disk, \$49.95**

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★ ★ **DOUBLE PRECISION FLOATING POINT FOR APPLESOFT™** (S-C Software) Extends the accuracy of the arithmetic available on the Apple from nine digits to a full 21-digit precision on all functions in Applesoft compatible format. **09409, Apple II Disk, \$29.95**

MCAP: A Microcomputer Circuit Analysis Program (Savon) Performs a linear voltage, impedance, or transfer impedance analysis of an electronic circuit. **04501, PET; 04503, TRS-80 Level II; 04504, Apple II; each tape \$24.95; 04513, Heathkit/Zenith Disk, \$29.95**

ENGINEERING MATHEMATICS-1 (Gilder) Contains eight programs useful to the engineer: 1. Solving Simultaneous Equations 2. Evaluation of a Polynomial 3. Quadratic Equations 4. Integration by Simpson's Rule 5. Newton-Raphson Roots 6. Derivative of a Function 7. Factorial of a Given Number 8. Extended Factorial Calculation. **01301, PET; 01303, TRS-80 Level II; 01304, Apple II; each tape \$14.95**

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COMPLEX MATHEMATICS (Gilder) Contains 8 programs that give the user the ability to perform computations of complex numbers in BASIC rather than in FORTRAN. The eight programs are: 1. Absolute Value 2. Complex Subtraction 4. Complex Multiplication 5. Complex Division 6. Nth Roots of a Complex Number 7. Complex Exponential 8. Complex Number to a Real Power. **01201, PET; 01203, TRS-80 Level II; 01204, Apple II; each tape \$14.95**

AT HOME

ENERGY MISER (SuperSoft Associates) A complete heating/cooling analysis program for your home or office that will calculate heat loss or gain due to poor insulation, leaky doors and windows, and more. **05601 PET; 05603, TRS-80 Level II; each tape \$29.95; 05609, Apple II Disk Version; 05613, Heathkit/Zenith Disk Version; \$29.95**

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GENERAL INTEREST

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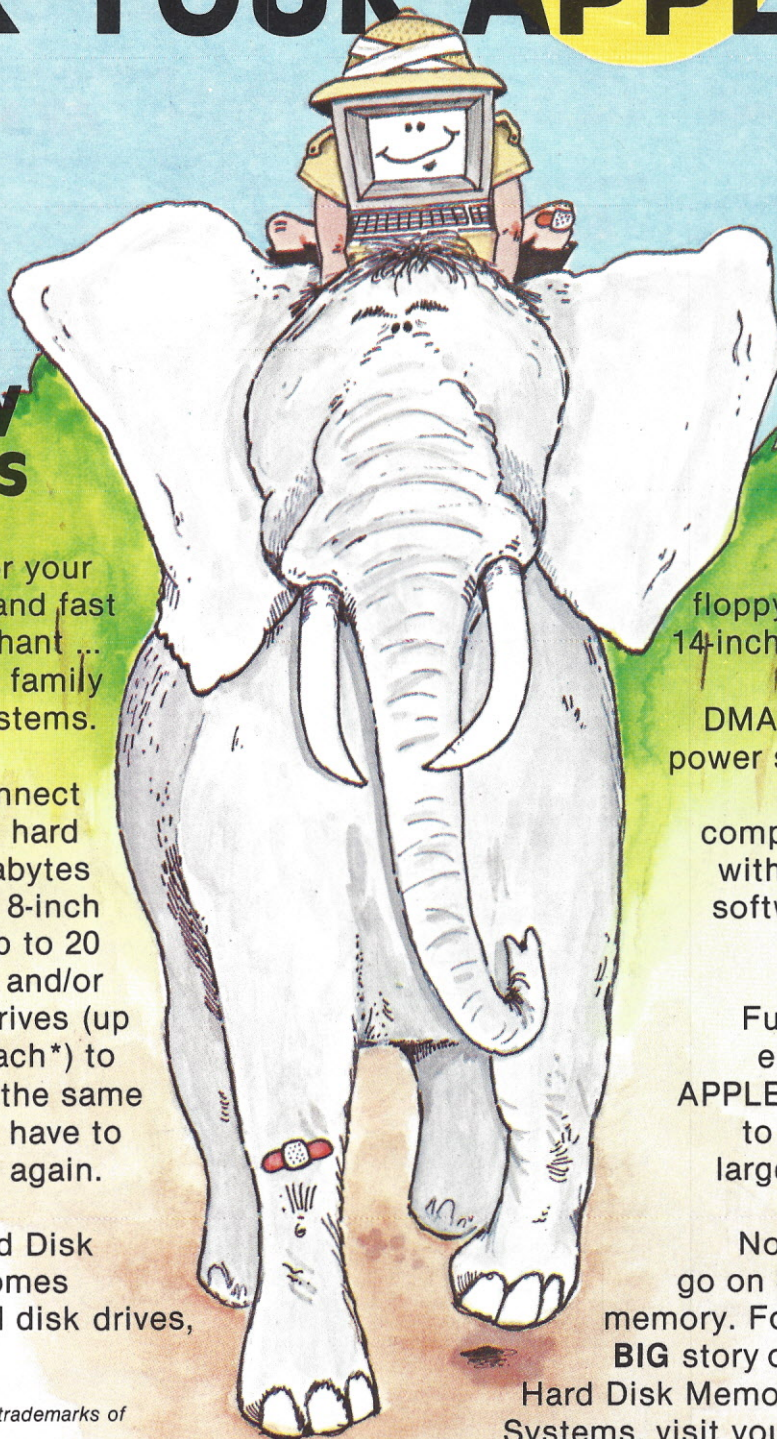
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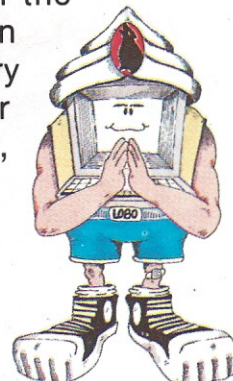


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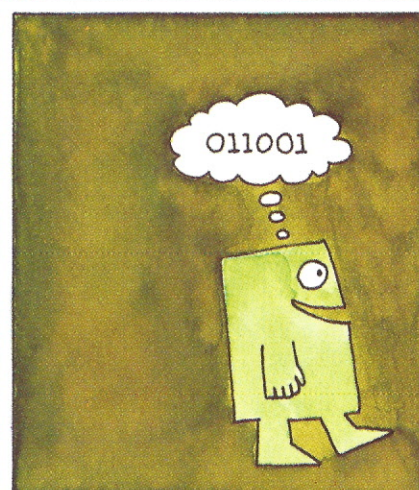
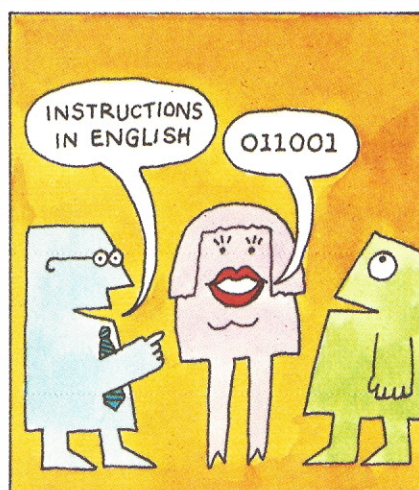
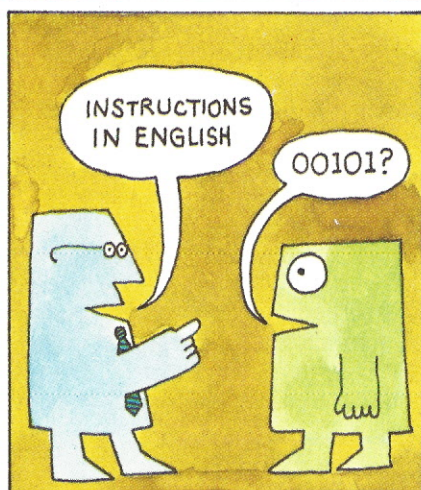
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Understanding Interpreters and Compilers



JOHN TROTA

When you use a high-level language to convey an instruction to a computer system, the statements in the high-level language have to be translated into the “on” and “off” (1 and 0) physical states that the computer system deals with. This translation process can be attained through an interpreter or a compiler.

An interpreter translates high-level language one way, while a compiler achieves that same end in a different fashion. An analogy will show

how each operates.

A computer program is similar to the instructions you would have to give a new employee, a clerk, to get him to do exactly as you wish. The difficulty is, however, that the clerk only understands a foreign language. But because he is so fast and accurate once he understands what you want, it's worth making special arrangements for the necessary translating.

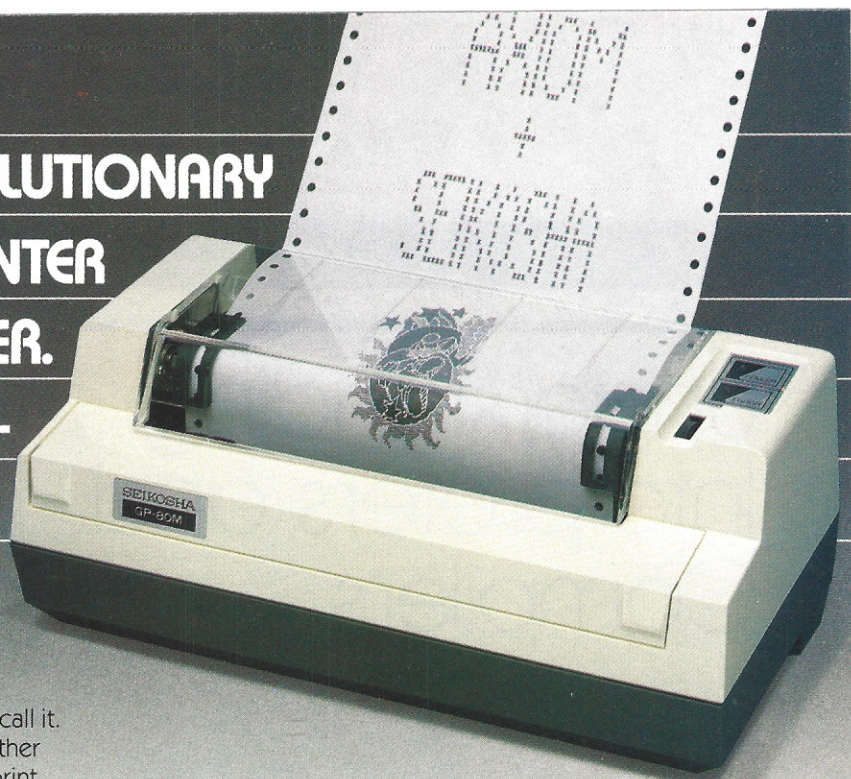
Enter the interpreter

You might, for instance, put each

of your instructions on a 3-by-5 index card and then number each of the cards so the clerk can keep them in order. If the clerk follows the instruction on each card in the proper sequence, he will wind up doing the job that you want him to do. You hand the stack of cards to the clerk and introduce him to another worker in the office who knows both English and the language of the new employee. The second worker is told to act as a translator and to interpret each instruction for the clerk.

The clerk shows a card to the *in-*

INTRODUCING A REVOLUTIONARY DOT MATRIX PRINTER WITH JUST ONE HAMMER. AT AN INCREDIBLE PRICE — JUST \$399.

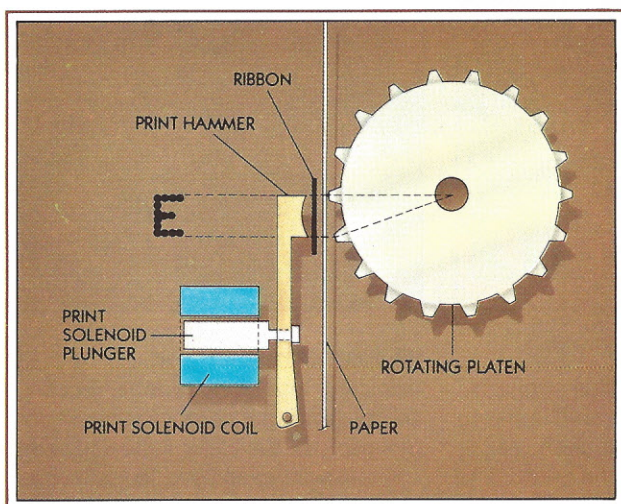


The Uni-Hammer Replaces Seven... or More.

Revolutionary? We don't know what else to call it. An impact printer with a single rugged hammer, rather than the seven or more individual solenoids and print wires found in conventional dot matrix printers.

At an incredible unit price of \$399!

Because of the unique Uni-Hammer design, the GP-80M is smaller and simpler than other dot matrix printers yet costs considerably less. Which makes it a natural for OEMs needing compact, reliable, low cost printers for system use, and also for the personal or small business user who wants a quality impact printer at the lowest possible price.



A Product of the Seiko Group

The GP-80M is manufactured by Seikosha and exclusively distributed in the USA by Axiom. It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

How the Uni-Hammer Works

The GP-80M, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

A Complete Printer

The GP-80M has features comparable to printers selling for thousands of dollars. These include upper/lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

Plenty of Interfaces

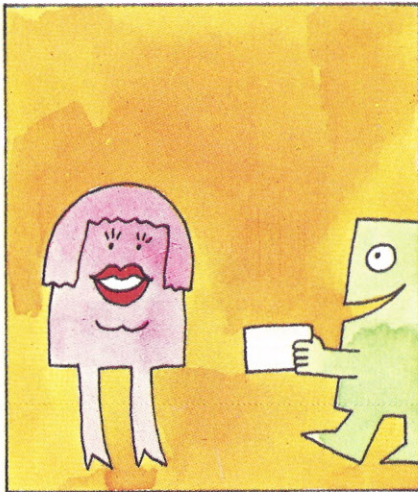
Interfaces include Centronics parallel, RS232C, serial TTL, 20mA current loop, IEEE-488, Apple, TRS-80, PET, HP-85... and more.

See the GP-80M in action at your local computer store, or write for the distributor in your area.

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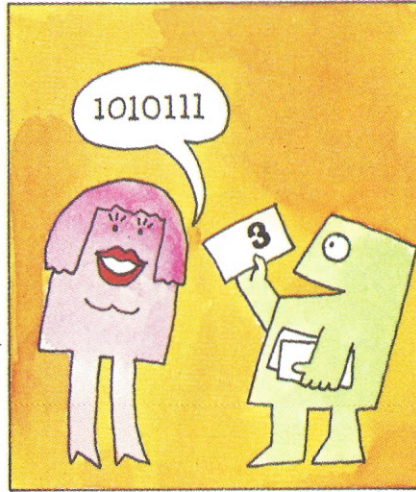
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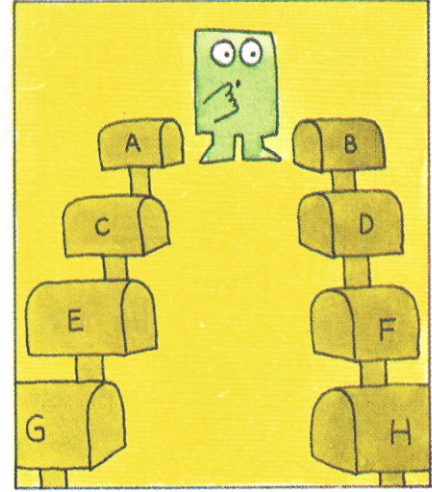
terpreter who looks at the instruction. She translates it into the language of the clerk, and the clerk dashes off to perform the instruction. When he has accomplished that single task, the clerk goes back to the interpreter, displays another card and follows the same process over and over again until the job is done.

If one of your instructions tells the

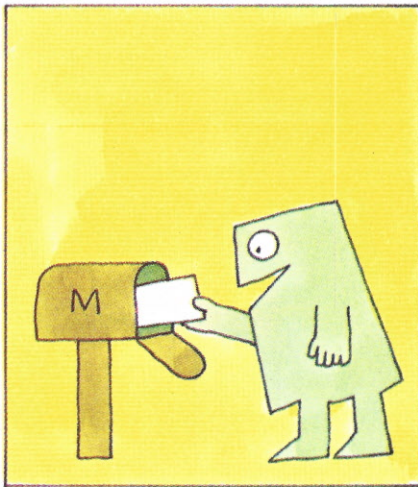


clerk to go to a different step in the card stack (you've saved time by referring to the numbers on the cards rather than writing out the same instruction over and over again), the clerk goes back to card No. 1 and pages through the stack sequentially until he finds himself at the card he was told to go to.

If one of the directions tells the

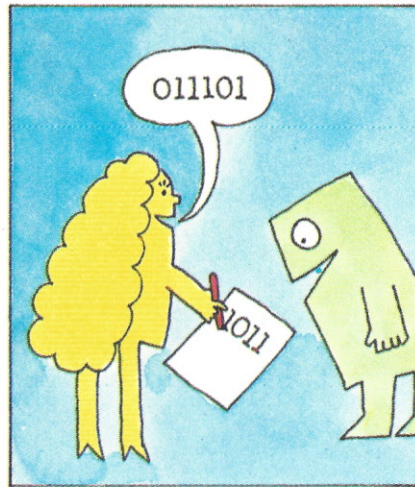


clerk to look in mailbox "M" (remember, he's still having the interpreter translate each instruction), and to take the information he finds there and use it, he looks for mailbox "M" by going to the first mailbox in the office. He looks at each mailbox in sequence until he recognizes the one marked "M." He takes the information, has it translated and uses



it as he was told to do.

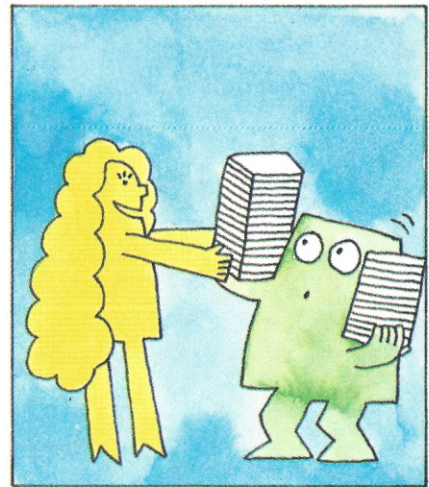
Like many new employees, the clerk works so hard on doing things exactly as he's told that he concentrates on only a single instruction at a time, to be sure he's getting it right. No matter how many times the clerk performs the same set of instructions or the same instruction within the set, he always has to have the directives translated, because he can't re-



member what something means when he sees it written out in English.

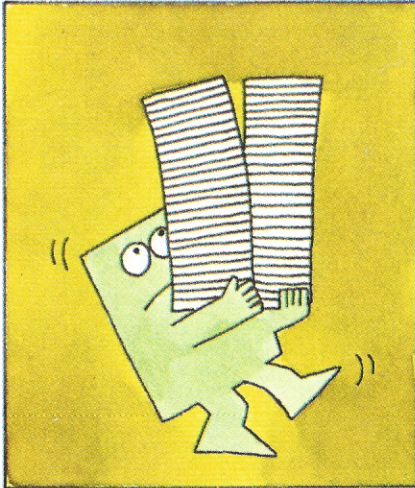
The compiler: added ability

If you are lucky enough to have a worker in the office who not only speaks the clerk's language but writes it as well, you can accomplish jobs faster. In this situation, the new clerk takes the stack of cards written in English, hands them over to the



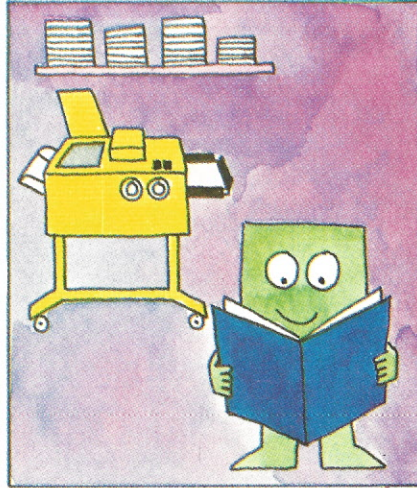
new translator, who, because of her added ability to write, is called a *compiler*.

The compiler looks at all of the cards and translates every one of them. She writes out a foreign language version of your instructions on a new set of cards and hands them to the clerk. The clerk wants to get started on the work but finds that his hands are occupied; in one hand he's



holding your English version cards, and in the other he's holding the translated version. He takes the cards to the office duplicating department and has the new cards put into book form.

The book, which is now an object that you can't understand but which your foreign employee can, is an *object program*. Interpreters and compilers are themselves object pro-



grams that have been written by someone else. These programs, using machine language commands and working on circuits that you don't get involved with, are part of a computer's operating system.

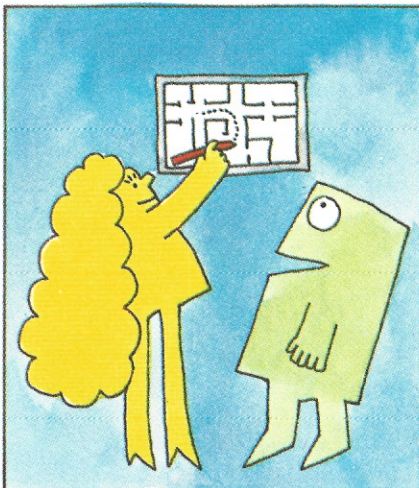
The clerk puts your English version of the cards on a shelf, in case you ever want them again. With one hand now free, the clerk takes his new book and performs all your in-



structions in a flash because he has them *all* in translated form.

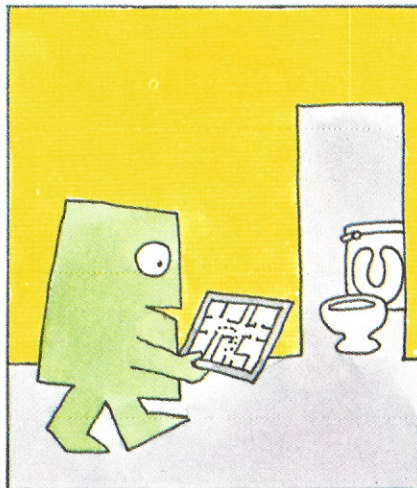
Differences in speed

As you can see, some of the differences between using an interpreter and a compiler are obvious. With the interpreter coworker, your clerk can get started on a job right away but he has to keep running back and forth to the interpreter's desk. No matter how fast the guy is,

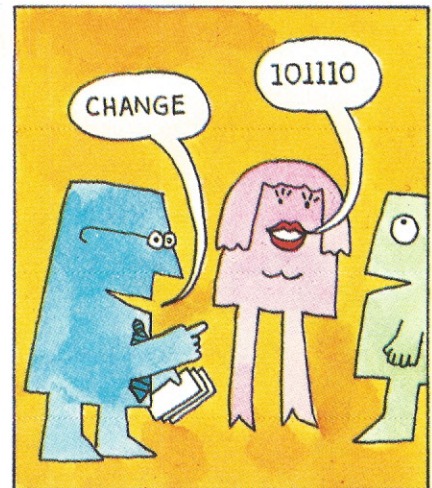


a lot of time is spent running. With the compiler, it takes longer to get started (because of the need to translate the cards and have them bound and then put away your original version, etc.) but once the clerk has that book prepared, watch out, because he can really move.

The compiler also helps the clerk in some ways beyond just translating all instructions at once. For one



thing, the compiler is so familiar with the clerk's language that she optimizes your instructions in his language, and this allows him to work even more quickly. On top of that, the compiler also draws the clerk a little map of the office and indicates where everything he needs to fulfill your instructions is located. When the clerk finds an instruction that tells him to go someplace or to



get something, he has a map and he can go directly to the location or item instead of searching all over the place until he finds what he's looking for.

Working with a computer is no different from working with your imaginary foreign employee. A computer that works with a high-level language in an interpretive mode

continued on page 77

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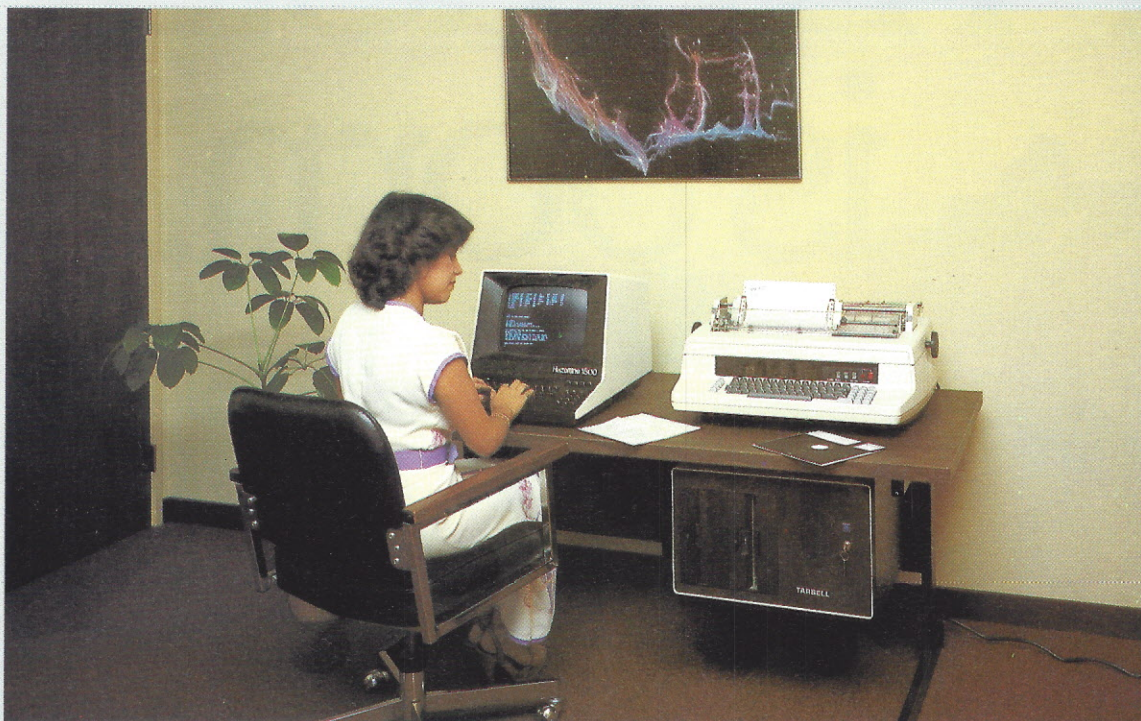


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Personal Computers: Products for Every Need

Ever since the appearance of the kit-form MITS Altair microcomputer in 1975, personal computer availability, quality and variety have mushroomed. Each week brings newer, faster, more powerful, more flexible systems. New systems with improved technology crowd out previous models. Few of the "old" models are more than five years old. Some models will become a footnote of history; others will become the "classics" of the technology.

With so many personal computers available that solve a wide variety of problems, it's hard for the average consumer to keep track of the various machines. This month, Personal Computing begins a two-part look at a cross section of some of the personal computers on the market.

Apple Computer's entries

An early entry in the personal computer market place was Apple Computer Co. The company's first entry was a single board computer, known as the Apple 1, that sold for \$666. In addition to its extremely low price, the computer featured system software in ROM and a built-in video interface.

Within a year of the introduction of the Apple 1, the Apple II was announced. With this unit, all that was needed to make it work was to plug it in and connect it to a video display. The computer was one of the most powerful computers available at the time and even today is one of the most popular. Realizing that users required increasingly more sophisticated systems, Apple set about designing its next generation machine, the Apple /// which has



The Apple III is available in two specific configurations: The Apple III Information Analyst is designed for budget development, forecasting, scheduling and other financial activities; the Apple III Word Processor offers full-function word processing.

recently become available in local computer stores.

A pair of Apples

When the Apple II was first announced the only BASIC in ROM that could be purchased was Integer BASIC. While this language was fine for writing fast games, it left a

lot to be desired when it came to applications that required numerical calculations because Integer BASIC does not recognize decimal numbers.

Heeding the uproar from users, Apple had a floating point BASIC developed by Microsoft and made it available on tape and disk. Known



Atari's model 800 is a user-oriented personal computer with a wide range of features and peripherals that make it useful in business, home and financial management, education and home entertainment.

as Applesoft, a ROM version of the language was eventually developed and sold as a plug-in board for the Apple II. Eventually, Apple replaced the Integer BASIC ROMs in the Apple II with the Applesoft ROMs, and thus the Apple II Plus was born. While both Apples are still manufactured, the Apple II Plus is probably the one that is most often purchased.

Other languages available too

By developing still another board for the computer, Apple has been able to put together still another system configuration, one that can be programmed in Pascal, FORTRAN or Pilot. The card that gives the Apple all this versatility is a RAM card that resides in the same area normally reserved for ROMs.

The RAM card, as developed by

Apple is known as the Language system, and it comes with several disks containing a UCSD Pascal p-code interpreter and compiler. The cost is \$500. Recently several other companies have announced the availability of RAM cards without the Pascal software for only \$200.

It's evolving slowly

Although an Apple II purchased today looks the same as an Apple purchased several years ago, there are many differences. To begin with, there have been several changes to the main circuit board of the computer, the latest one being made to reduce interference as required by the FCC. The FCC's interference regulations have caused other barely noticeable changes in the Apple II: the inside of the case is painted with

a conductive shielding paint and all peripheral interfaces are designed to accept shielded ribbon cables.

Besides these most recent changes, Apple has made others as well including changes in the keyboard. One big problem with early Apple keyboards was that it was easy to hit the reset key and drop out of the program that was running. New keyboards have a switch that can be flipped so that a Control-Reset is required to perform the reset operation.

The biggest drawback of the Apple II has always been its text display; it's limited to 40 upper case characters per line. Several outside vendors, hearing enough people complain, came up with solutions to the problem. Several of them designed 80-column boards that plug into one of the empty slots in the Apple. Use of these boards produces a nice 80-column display, however, video monitors and not TVs must be used as the display device.

For those who still wish upper and lower case capability and want to use a TV set as a display, several lower case adapters such as the Lazer Systems can be used. These maintain the 40-column format and simply add the lower case capability.

The Apple /// has arrived

When Apple Computer premiered the Apple /// at the '79 National Computer Conference, it was billed as the greatest personal machine ever designed for a small business. Designed as a "total solution" machine, the Apple ///s shown at NCC came in two configurations: the "Information Analyst" and the "Word Processor." Despite Apple's insistence that the Apple /// would be available soon after its introduction, it took almost nine months for the computer to reach dealers' shelves. But it has finally arrived.

The Apple /// is a 6502-based computer that can address up to 512 kilobytes of random access memory but the current maximum supplied is 128K bytes. Built into the Apple /// are a disk drive, an RS-232 serial interface, a Silentype (tm) interface, a dual joystick interface, and an exter-

nal sound. A clock/calendar was originally included, but Apple is having difficulty finding a supplier for the integrated circuit needed for this feature. The Apple /// has four expansion slots for Apple II-like interface cards, and although Apple says the cards for the Apple II won't work, it's not really so. Many of the Apple II peripheral cards will work, but because of their electrical design they would result in increased levels of radio interference. To eliminate problems with the FCC, the official line is—no Apple II cards will work with the Apple ///. The console interface includes a full feature upper/lower case keyboard allowing the entry of all 128 ASCII characters. In addition, a thirteen-key keypad lets the user easily enter numeric data. The video screen sports a 40- or 80-column by 24-line text display with user definable characters and several high resolution graphics modes.

One of the powerful features of the Apple /// is its operating system (see page 83). However, the price paid for this power is complexity. Effective programming on the Apple /// is difficult and several sophisticated Apple II programmers have already indicated that they won't bother with the Apple ///.

Although very little software is currently available for the Apple ///, by using the Apple II emulation program supplied on diskette, it is possible to run most, but not all, of the software available for Apple II.

Atari computers

Atari, the well-known game manufacturer, offers two personal computers: the Atari 400, an entry-level machine with a touch sensitive keyboard designed for the home; and the Atari 800, a standard typewriter keyboard unit intended for professional and small business applications.

The Atari 400 comes with 8K of random access memory but the machine uses 3K for internal operations leaving only 5K of memory available to the user. Internal RAM memory can be expanded to a maximum of only 16K. The 400 includes a 10K



Commodore offers a wide range of systems to satisfy the needs of individuals from entry level to professional applications.



Heath's H-89 All-In-One-Computer offers two microprocessors, a high resolution CRT video display, built-in floppy disk drive, and 64K of Random Access Memory.

ROM operating system. ROM may be expanded to 26K with user-installed, solid-state cartridge programs. The unit has a slot for Read

Only Memory cartridges that feature ready-made, easy to use programs covering a variety of games and personal applications.



The HP-85 (left) and the HP-83 are professionally-oriented systems designed for engineers, scientists, accountants, investment analysts and serious home and instructional uses.



Ohio Scientific's CIP Series 2 small computers have durable keyboards, standard closed-circuit television hookup capability, wide range of screen formats and BASIC language make the machine good for educational uses.

The 400 has a touch-sensitive, flat keyboard whose chassis houses the 6502 microprocessor, plug connectors for external peripherals and a built-in RF modulator so that you

can attach the unit to your own black and white or color television set. The unit features graphics in 16 colors and there are four independent sound synthesizers for musical tones

or game sounds. Sounds emanate from an internal speaker and the audio channels of a television.

In addition to the display monitor, you can connect game controls, cassette recorder for program storage, 40- or 80-column dot matrix impact printers, acoustic modem, and an interface module.

The Atari 800 has a typewriter-style keyboard, built-in RF modulator, high resolution graphics and an internal speaker. The machine comes with 8K of RAM, 8K of internal ROM and place for memory expansion modules that can bring the machine up to a total of 48K RAM. External ROM can be expanded by 16K with cartridge programs. Atari BASIC was written by Shepardson Microsystems, which differs in some important respects from the Microsoft BASIC found in most of today's personal computers. Programs written for Microsoft BASIC require significant changes before they will run on an Atari. A version of Microsoft BASIC for the Atari is expected to be available soon.

Both the 400 and 800 have an eight-thousand byte BASIC in an ROM cartridge.

In addition to the peripherals for the Atari 400, the Atari 800 can have one to four minidisk drives storing from 96 to 368K bytes of on-line data storage.

Commodore Computers

Commodore Business Machines entered the world of small computers with the introduction of the PET (Personal Electronic Transactor) in 1977. CBM's initial machine, a 4K RAM unit with a 6502 microprocessor, was really the forerunner of the numerous packaged computer systems on the market today.

When the PET first came out, the unit's keyboard consisted of 73 keys configured in an ASCII block of 53 keys and a 20-key numeric/control key block. The keys were calculator-type push buttons and were not arranged in the staggered format found on a standard typewriter making it difficult to touch type on the first machines.

Initially, Commodore supplied

the PET only with a built-in cassette, but by the end of 1979 the firm added at least two printers, dual disk drives, software and user manuals. The company also started referring to its 16K and 32K version machines with optional numeric keypads and high-quality typewriter-style keyboards as CBM systems. The upgraded machines were aimed at the business market. Commodore eventually came out with a PET that had a standard-sized keyboard. CBM computers offer full upper and lower case character sets, special graphics characters and special function keys.

With the addition of a new keyboard, Commodore redesigned the PET so that up to 32K of memory could be used and the firm increased its basic machine from 8K to 16K with an increase in price as well.

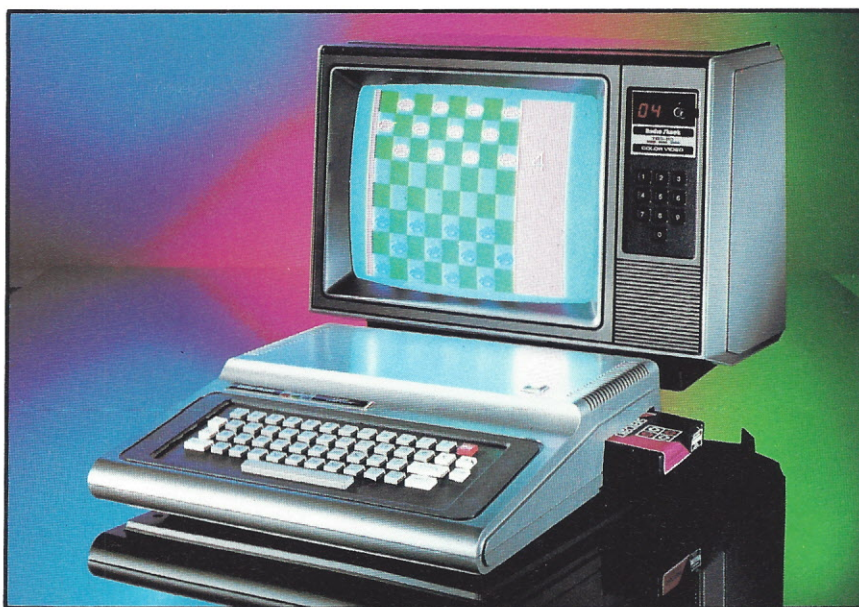
PET's entry into the consumer market brought with it many features that are now taken for granted in today's machines. For instance, the PET was the first computer with BASIC in ROM and able to operate in BASIC as soon as it was turned on. The unit also had a good screen editor which made the computer easy to work with.

Current CBM computers include the PET 2001-8K Personal Computer. This is a standard PET with integral cassette, 40-column by 25-line display, calculator-type keyboard and 8K of Random Access Memory. The unit falls in the \$800 range.

The PET 2001 Professional Computer has a large, terminal-style keyboard with separate numeric keypad and graphic keys, and a 40-column by 25-line display. Memory can be expanded to 32K. An external cassette recorder is optional.

A CBM 2001 Business Computer is similar to the professional model except that the business machine's standard typewriter keyboard doesn't have graphic keys. The professional and business computers fall in the \$800 to \$1,300 range.

CBM's 8000 Business Computer features a typewriter-style keyboard with separate numeric keypad,



The TRS-80 Color Computer offers color graphics, instant-load program packs, expandability and sound. Since it attaches to any color television set, the system can easily be used for personal, home and educational uses.

80-column by 25-line display, screen editor, and an advanced operating system. The CBM 8000 sells for \$1,500 to \$1,800.

The PET keyboard chassis provides four connections: two digital cassette unit devices, a parallel input/output device and an IEEE-488 compatible input/output device. User-furnished memory can be added to the system through an internal memory expansion connector.

A 14K ROM comes with the units with an additional 8K bytes available. The PETs and CBMs use Microsoft floating point BASIC in ROM and have an assembler development package for those systems having a disk drive, printer, and at least 16K RAM.

In January 1981, Commodore added two more computers to its line. The first was the CBM 8096, an upgraded version of the 8032. Like the 8032, the 8096 features an 80-column screen. Its main difference is that it contains 96K of random access memory. This extra memory makes it possible for additional languages such as FORTRAN and COBOL to be used.

Commodore's second new entry, the VIC 20, is at the low end of the

price scale. At \$299 the VIC 20 is the lowest cost color computer announced to date. The basic unit comes with 5K of user available memory and contains a built-in RF modulator so that it can be directly connected to the antenna terminals of any television set. Other features of the VIC 20 include: programmable function keys, a programmable sound generator, memory expansion to 32K, a full size typewriter keyboard, a 22-character by 23-line display high-resolution graphics, joystick, paddles, lightpen and external plug-in program cartridges. The VIC 20 is expected to be available during the second half of 1981.

Heath series

The Heath H-89 all-in-one-computer, based on the popular Z-80 is an integrated desk top machine that has a minidisk drive, black and white display, typewriter-style keyboard and 16 to 48 thousand bytes of random access memory. The H-89 is a composite of a Heath video monitor, the microprocessor and the disk drive.

Heath entered the small computer field in 1977 with the sale of its H8 (\$1,000 to \$2,000) and H11 (\$1,400 to \$2,000) computer systems in both kit



The Texas Instruments 99/4 personal computer can help youngsters improve their math, grammar, reading and spelling skills. Colorful, entertaining pictures make learning fun and encourage achievement.

and fully assembled forms. In 1979, Heath added the H88/H89 computer. Zenith Radio Corporation acquired Heath that year and set up the Zenith Data System division that operates in parallel with Heath. The Heath division deals with consumer sales of its products while Zenith sells the H89 and the H11 under the names of Z-89 and WH-11A.

The H-89 (\$1,700 to \$2,900) features a microprocessor-controlled video terminal, a 72-key keyboard, and a second Z80 microprocessor that serves as the computer. The 12-inch display has both upper case and lower case letters with true descenders. There are up to twenty-four 80-character lines on the video.

Peripherals for the system include two additional minidisk drives in a separate single housing, a number of printers and a data communications modem. The built-in floppy drive provides up to 102K of storage.

The system uses extended Benton-Harbor BASIC. Microsoft BASIC is also available as is CP/M. An assembler, text editor, debugger and

utility programs are also available.

Hewlett-Packard's HP-85

Hewlett-Packard's HP-85 is a computer designed for engineers, scientists, accountants and investment analysts.

The system, the size of a portable typewriter, contains a custom microprocessor, typewriter-like keyboard, five-inch video monitor, thermal printer, and tape cartridge. The small unit also has graphics functions.

In addition to its computation and graphics capabilities, the HP-85 is equipped with four input/output ports that hold a range of optional interfaces which let you expand the system to include plotters, printers, disk drives and other peripherals as they become available.

The system comes with 16K of Random Access Memory which can be expanded to 32K by plugging in an optional memory module into one of the input/output ports on the back of the machine.

The unit's keyboard is divided into four sets of functions: typewriter keyboard for entering let-

ters, etc.; numeric keypad for entering numbers and doing arithmetic operations; "soft" keys that are assigned functions by you during program development; and display, editing and system control keys that permit you to control the CRT, operating system, tape drive and printer.

In the alphanumeric mode the monitor displays sixteen 32-character lines but the HP-85 remembers up to 64 lines of type which can be viewed by scrolling the CRT display up or down. When operating in the graphics mode, the display is broken down into a 256 by 192 dot field that provides high resolution plotting. The HP-85 stores both the last alphanumeric display and the last graphics display—a feature that allows you to switch from one mode to the other without losing data from either.

The bidirectional thermal printer, which operates in alphanumeric and graphics modes, prints two 32-character lines per second. In the alphanumeric mode the unit prints upper and lower case letters, numerals and special symbols. You can also underline. The system has limited editing capability.

The HP-85 tape drive uses HP data cartridges which have a user capacity of 217K bytes. The drive operates at a read/write speed of 10 inches per second and a search speed of 60 inches per second. The HP-85 automatically sets up a tape directory at the beginning of each tape. Using this table of contents, the system finds exact tape locations of recorded programs and data. The HP-85 sells for approximately \$3,250.

BASIC programming language on the machine includes string and editing functions, 42 predefined functions and 12-digit accuracy.

Hewlett-Packard also offers the HP-83 which is similar to an HP-85 without the cartridge tape and thermal printer. The HP-83, which can be connected to external printers and floppy disk drives, sells for \$2,250.

Ohio Scientific Challengers

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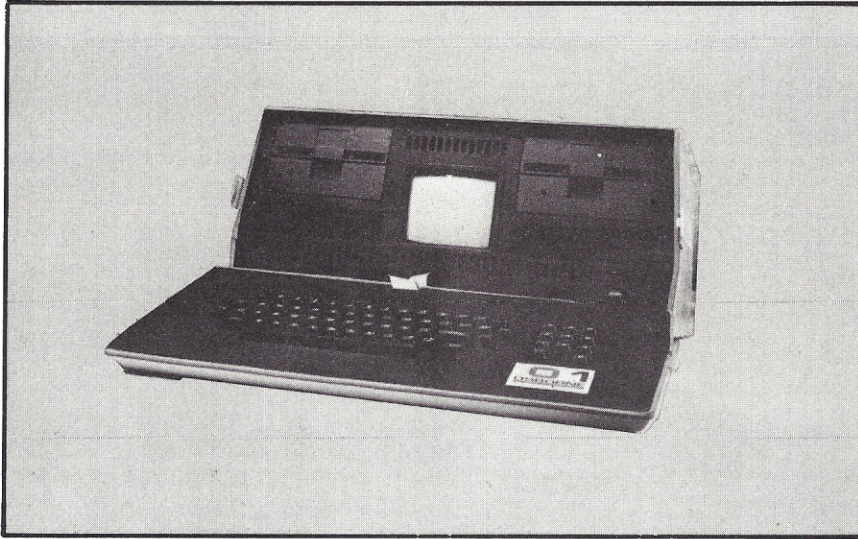
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(PC-5/81)



Litton

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The new Osborne I Computer, a self-contained portable system that can operate for up to five hours away from an electrical outlet, weighs approximately 20 pounds.

Challenger series of small computers covers a broad range of users. The Challenger I is targeted toward students and hobbyists. Challenger I computers break down into the C1P Series 2 and the C1P MF Series 2 with prices ranging from \$600 to \$1,400. The \$900 to \$2,800 Challenger II systems are designed for educational, professional, home and small business uses while the Challenger III line, with prices from \$4,000 to \$14,000, is aimed at commercial users.

OSI provides a range of peripheral devices for the Challenger series. The Challenger I requires the addition of a video monitor, which can be your own television, as well as either a cassette recorder or diskette drive. A 32K machine can have dual floppy disk drives, home controller system, communications capability and a line printer. Systems with disk drives cannot also use tape storage.

Microsoft BASIC in ROM is standard. For systems with more than 20K bytes of Random Access Memory, an enhanced version of BASIC is available with the Ohio Scientific Operating System.

System expansion is confined generally to the products that Ohio Scientific offers because the Challenger's lack of standard input/output electronics results in few inde-

pendently manufactured peripherals.

In many respects the Challenger I is a good entry level system because you can get a disk-based machine for less than most of the competition charges. Prepackaged software is limited, however, compared to many of the other small computer systems around.

The Challenger II series consists of the C4P DF, C4P MF and C4P cassette system.

The C4P series was first introduced in June of 1979. The cassette-based C4P has been enhanced by additional power supply capacity to make it plug expandable to the larger models. The new C4P MF incorporates a small computer system with full 53-key keyboard, color video display with graphics capability, disk storage and applications software including word processing, information management, education, entertainment, etc.

The machine has a total of 52K memory standard. Of this, 48K is RAM but only 36K is available because the rest is used by the machine.

A C4P DF comes with Ohio Scientific's small business and developmental operating system and the firm's network and hard disk compatible operating system. Systems cost approximately \$2,800.

The C4P MF provides all the features of the C4P DF except that it comes with a single mini-floppy disk and 24K of RAM. The company says the C4P MF is suited for all the applications of the C4P DF except when extensive business use in conjunction with large disk files is anticipated. The C4P MF is aimed at educational and entertainment applications as well as for use as a personalized managerial tool for executives, managers, educators, scientists, engineers and other professionals. System prices are around \$1,800.

The C4P cassette system is an entry level computer system that provides many of the features and capabilities of the floppy-disk based 4P products in a BASIC-in-ROM and cassette storage configuration. The machine comes with keyboard, video display interface, BASIC, sound outputs, joystick and remote keypad interfaces and remote control capability. Systems sell for \$900 to \$1,000.

New Osborne computer

The latest personal computer to hit the scene is the Osborne I Computer System which made its appearance in April at the West Coast Computer Faire. The system's \$1,795 retail price includes 64K RAM, Z80A microprocessor, a "business" keyboard, five-inch video monitor, serial interface, IEEE 488 interface, dual 100K minifloppies and software. One of the most unique features of the system is that the keyboard and computer snap together to form a weatherproof carrying case.

Software for the system will be Digital Research's CP/M Operating System; CBASIC programming language, MBASIC language, the WordStar word processing system with a MailMerge option, and a CP/M compatible electronic worksheet called SUPERCALC.

A five-inch video monitor provides 52 characters and 24 rows. The monitor is a "window" into a 128-character by 34-row screen implemented in 4K of random access memory. The screen, which displays

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upper and lower case letters and underlining, has two intensities, as well as graphics capabilities.

The minidisk drives are single-side, single-density units and the system contains pockets in which diskettes can be stored.

Sixty thousand bytes of the computer's 64KByte random access memory are available to the user with the 4K of RAM used by the screen. A brushed aluminum weatherproof cabinet forms a portable carrying case.

According to Osborne Computer Corporation, hardware options will include: double-density, double-sided minidisk drives; a nine-inch monitor which reproduces the five-inch display; a battery pack providing three to five hours of operation away from an electrical outlet; modem electronics and an acoustic coupler; and a 12-inch monitor providing an 80-column display.

Prices and availability dates for the additional hardware options have not been specified.

Radio Shack Computers

Radio Shack has been credited with opening the doors to personal computers for the average consumer. The introduction of the TRS-80 Model I in 1977 paved the way for a consumer to own what had been considered a science-fiction machine in previous decades. The TRS-80 was neither the first nor necessarily the best of the early personal computers; but it was the most available and least expensive of the new machines. The system found an audience of nonhardware-oriented consumers ready to pounce on a new concept. In the short time since the TRS-80 appeared, the personal computer market has witnessed a vast number of changes, and Radio Shack has taken the lead in introducing new and more refined products...

TRS-80 Model I

The Model I has been retired from production due to radio frequency interference problems and new technology. It is still, however, one of the most common computers in the Tandy line. Radio Shack said it will continue to support the Model I with peripheral equipment as long as the demand is there, so the system cannot be counted out yet.

The Model I features "modular design." It could be purchased as individual components—much like a stereo system—as you desire. The primary unit in the Model I is a self-contained computer/keyboard combination, with optional TV monitor (CRT) and cassette recorder. The system was first introduced with a language called Level I BASIC,

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which is a subset of the more powerful Level II BASIC, and 4K of random access memory (RAM). A beginner would be hard-pressed to find an easier way to learn to use a computer; the manual supplied with the Model I is one of the finest works written for a first-time user. The Model I can be expanded to Level II BASIC and 16K of RAM with no additional peripheral devices.

When a Model I user expands the system, the person can add an Expansion Interface unit, which provides for the addition of up to 32K RAM, an RS-232-C interface board (for telecommunications or serial printers), and connection for disk drive units. The expansion interface includes a parallel printer port and the necessary controller circuits for up to four disk drives. Various parallel printers and disk drives, as well as the expansion interface units, are still being manufactured by Radio Shack.

The TRS-80 Model I is supported by numerous independent manufacturers, and a vast array of hardware and software can be found on the market.

Model II

Shortly after introducing the TRS-80 Model I, Tandy brought out the TRS-80 Model II. This sophisticated business system features a faster Z-80 processor, eight-inch disk drives (one internal, three external), and a true "monitor" type CRT, all contained in one package. The Model II is oriented toward the business market rather than the personal sector primarily because of its price, which starts at \$3,450 for a 32K single disk drive unit.

The Model II can be expanded to a full 64K with four disk drives, and it supports many popular languages such as BASIC, COBOL and FORTRAN as well as the popular CP/M operating system. A vast array of business-oriented software is available through Radio Shack, as well as from independent suppliers.

Model III

The recently-introduced TRS-80 Model III, a greatly enhanced version of the Model I, combines some

of the better features of both the Model I and II. Abandoning the Model I modular design, the Model III is self-contained in one case which provides for up to 48K of RAM (the lower 16K, as in the Model I, contains the BASIC Language interpreter), two disk drives (double density), and an RS-232 interface. Included in the primary configuration is a parallel printer port, a full ASCII character set (with 160 "special" graphics characters), upper/lower case drivers, and a numeric keypad. The Model III may be purchased with Level I BASIC and 4K of memory for \$699, or the more useful "Model III BASIC" with 16K of RAM for \$999. You pay extra for a tape recorder and cable.

The Model III is a well-designed, logical outgrowth of the TRS-80 line. Among the improvements over the Model I are: a Model II-type CRT; a "video-wait" line, which improves the CRT picture; a system of "port" selection that gives you control over 128 port addresses; improved keyboard design (also available in later Model I's); and, up to four double-density, 40-track, 5 1/4 inch disk drives. The Model III also provides for two tape-storage baud rates—500 or 1500.

The Model III maintains a certain software compatibility with the Model I, and some (but not all) of the products available for the Model I will run on the new machine with few or no modifications.

TRS-80 Color Computer

The TRS-80 Color Computer is a departure from the Radio Shack model line. The TRS80C is based on Motorola's new MC6809E microprocessor, rather than the Z-80, used in Radio Shack's other systems. The machine includes another "first" from Motorola: the SAM (Synchronous Address Multiplexer) chip, which provides many services to the system that were previously handled by the Z-80 CPU (memory refresh, address selection and data transfer).

The TRS80C is modular. The

continued on page 74

NEW!!! THE ELECTRIC MOUTH*



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Now — teach your computer to talk, dramatically increasing the interaction between you and your machine.

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six	fifty	80hertz tone	flow	less	over	star	h	y							
seven	sixty	20ms silence	fuel	lesser	parenthesis	start	i								
eight	seventy	40ms silence	gallon	limit	percent	stop									
nine	eighty	60ms silence	go	low	please	than	k								
ten	ninety	160ms silence	gram	lower	plus	the	l								
eleven	hundred	320ms silence	great	mark	point	time	m								
twelve	thousand	cent	greater	meter	pound	try	n								
thirteen	million	check	have	mile	pulses	up	o								
fourteen	zero	comma	high	milli	rate	volt	p								
fifteen	again	control	higher	minus	re	weight	q								
sixteen	ampere	danger	hour	minute	ready	a	r								
seventeen	and	degree	in	near	right	b	s								

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SUPER STAR BASEBALL

ALL TIME
SUPER STAR BASEBALL
Sample Lineup

SUPER STAR BASEBALL
Sample Lineup

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J. DiMaggio	H. Greenberg	W. Mays	L. Brock
J. Jackson	R. Hornsby	P. Rose	R. Carew
G. Sisler	H. Wilson	O. Cepeda	H. Killebrew
S. Musial	B. Terry	C. Yazstremski	R. Allen
T. Cobb	M. Mantle	W. McCovey	R. Leflore
W. Mays	H. Aaron	R. Jackson	R. Zisk
C. Young-P	W. Johnson-p	G. Brett	B. Madlock
		R. Guidry-P	T. Seaver-p

Performance is based on the interaction of actual batting and pitching data. Game can be played by one or two players with the computer acting as a second player when desired. Players select rosters and lineups and exercise strategic choices including hit and run, base stealing, pinch hitting, intentional walk, etc. Highly realistic, there are two versions, ALL TIME SUPER STAR BASEBALL, and SUPER STAR BASEBALL featuring players of the current decade. Each includes about 50 players allowing nearly an infinite number of roster and lineup possibilities.

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Indexing Information With a TRS-80

most books for technical manuals come with indexes, so you can fish out information in a hurry. But what do you do if a manual you are using constantly doesn't come with this convenience? If you chafe as long as I did over my indexless Level II manual for the TRS-80, sooner or later you draw up your own index. You can do it manually by getting a set of blank cards, writing one topic and page number on each, then alphabetizing the cards and typing up the index. Or you can let the computer do the job much, much quicker.

I ended up writing a program for the index. In the process it became a general program to handle the indexing of any material, whether a new book or long term paper for school or collection of recipes.

When the program first comes up, it will ask you to enter a topic and a page in the format TOPIC comma PAGE—for example, ERROR CODES, B/1. The page is carried as a string variable, so that slashes, dashes and what have you can be used. Topics containing commas must be enclosed in quotes.

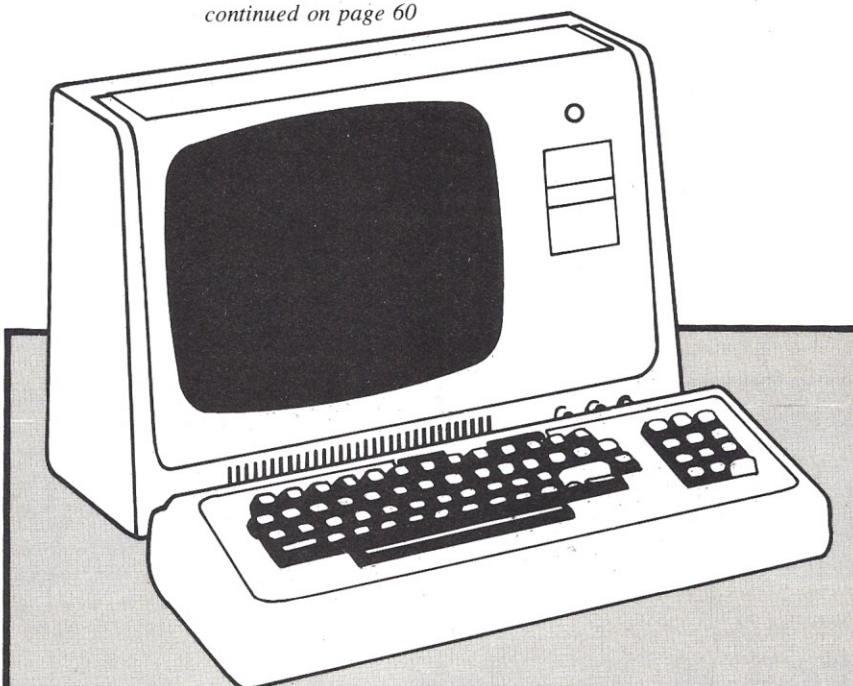
To end data entry, enter 999 and a dummy page number. If you're curious about how much string space you have left, enter 888 and a dummy page number. (I tried putting a trap in the program to warn about running out of space, but it takes the TRS-80 so long to chase around and figure out how much string space is left that it wasn't worth it.)

When you are finished entering information, the data will be presented for review, and you will have a

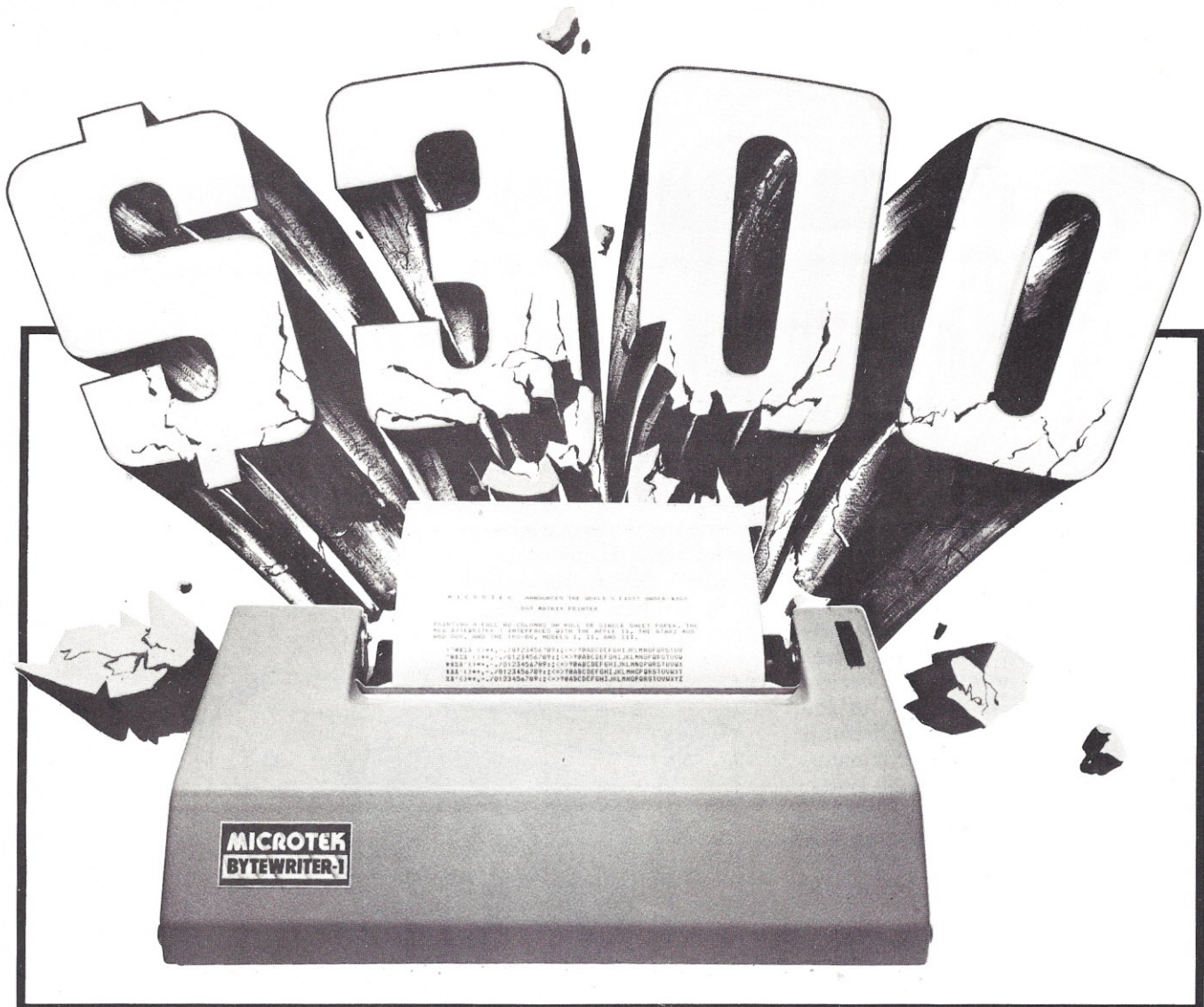
chance to add or change data anywhere along the line. The restart option lets you pick up where you left off after a change, rather than having to go back to the beginning.

You will wind up back at a menu

continued on page 60



ABBREVIATIONS	1/7	FUNCTIONS	F/1
ARITHMETIC	1/4	GOTO	4/5
ARRAYS	1/4	GRAPHICS	1/6
ASCII CODES	C/1	IF-THEN	4/12
CASSETTES	10/1	KEYBOARD	1/7
COMMANDS	A/1	LINE PRINTER	10/2
CONVERSIONS	G/1	LIST	2/4
DATA	4/14	LPRINT	10/2
DELETE	2/3	OPERATING MODES	1/1
DISKS	10/3	PEEK	8/5
EDITING	9/1	POKE	8/5
ELSE	4/13	POWER-UP	1/1
ERROR CODES	B/1	RANDOM	7/3
ERROR MESSAGES	1/6	READ	3/9



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But cost-effective designs and efficient manufacturing operations weren't enough. Computer retailers can make up to a \$250 markup on the foreign models. Could we hold to a \$299 list price and give the dealer enough incentive to sell the Bytewriter-1? No way. We had to try a more direct approach.

YOUR BUY DECISION - DEALER OR MAIL ORDER

There are some very good reasons to buy your first computer through a dealer. There is a certain amount of hand-holding required when you decide to buy a personal computer. This is one of the main functions of the retail computer store. And most of them perform this function very well.

But why would anyone want to buy add-on equipment through a dealer? If you find a product that has been designed for and tested with your particular computer, you can safely bypass the computer dealer. You can have the best of both worlds. You can save money by buying direct from the manufacturer, and you can be certain that your new device will work when you get it.

We've done extensive testing with the most popular computers - the TRS-80, the Apple II, and the Atari 400 and 800. If you own one of these computers, we guarantee you won't have any interface problems with the Bytewriter-1.

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FOUR THINGS YOU SHOULD KNOW BEFORE YOU BUY THIS PRINTER

We don't want any unhappy customers. We'd like you to know the limitations of our printer, as well as its advantages. There are some differences between the Bytewriter-1 and the higher priced printers you may be looking at:

- 1) The Bytewriter-1 takes single sheet and roll paper only. No pin feed paper.
- 2) We've used a 7-wire print head. No fancy lower case descenders.
- 3) There aren't any software frills in the Bytewriter-1, like VFU controls. However, if your main interest is getting software listings or printing letters, you won't care. And, with a bit of ingenuity, you can provide VFU functions in your own programs.
- 4) You can't go into a computer store and pick up a Bytewriter-1. They're sold direct only by MICROTEK.

We realize it's unusual to point out the limitations of a product in an ad that promotes it, but we think it's important for mail order buyers to fully understand what they're buying.

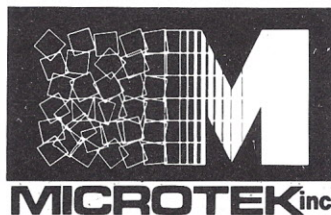
The Bytewriter-1 will fill the needs of most people. People who don't see the sense in spending extra money for features they'll never use.

ORDER THE CONFIGURATION THAT'S JUST RIGHT FOR YOU

The Bytewriter-1 is available with an interface cable and complete instructions for use with three of the most popular small computers on the market today, the Apple II, the Atari 400/800, and TRS-80 Models I, II, and III. One of our divisions, MICROTEK PERIPHERALS CORP., can even provide you with the expansion card or module that your computer may require to drive a printer.

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even after the index has been listed alphabetically. You can still go back and change or add data at that point by selecting the "review input" option. The only way out of the program is to press the BREAK key.

Understanding the program

The program is a simple one and all of the initialization that is required is done in the first four lines (100 through 130). After initialization the program starts asking the user to enter the topic that is going to be indexed and the page that it appears on. Line 100 sets aside space for up to 10,000 characters which can be organized into a maximum of 300 items. The number of items allowed is limited by the dimension statement in line 120. This can be changed to suit your needs. Line 145 checks to see if the user is requesting information on how much memory is available, while line 150 allows you to review what has already been entered. If the review mode is chosen, the program jumps to line 170 where the current list is printed out and the user is given the option of adding to the list, making changes, continuing or starting all over. The code for making additions is in line 230, while the code for making changes is on line 250 and 260.

If the (G)O ON option is chosen, the program jumps to line 300 where the user can choose to alphabetize the current list or go to a menu that lists all of the available options. Alphabetizing is done in lines 340 and 370 where a standard bubble sorting technique is used.

For those of you who will be alphabetizing very long lists, you might find the bubble sort too slow. In this case, you might want to replace lines 340 and 370 with a routine that uses the Shell-Metzner, Quicksort or Heapsort schemes. You can make other changes to the program as well that will enhance its usefulness. One of these is to change the PRINT statements in line 180 and/or line 400 to LPRINT. This will cause the index to be printed out on your printer. □

Program Listing

```

100 CLEAR1000
110 DEFINTI-Z
120 DIMT$(300,2)
130 CLS:N=0:E$="999":Q$="888"
140 N=N+1:PRINT"ENTER
TOPIC,PAGE";N:INPUTT$(N,1),T$(N,2)
145 IFT$(N,1)=Q$THENPRINTTAB(5)"ROOM
FOR";FRE(Q$);"CHARACTERS LEFT.":N=N+1
150 IFT$(N,1)=E$THENN=N-1:GOTO170
160 GOTO140
170 CLS:INPUT"INPUT REVIEW: PRESS ENTER TO
START";Z$:J=1:L=0
180 CLS:FORI=JTON:L=L+1:PRINT(";I;")
";T$(I,1);" ";T$(I,2)
190 IFL<15THEN290
200 INPUT"(A)DD, (C)HANGE, (G)O ON,
(R)ESTART";Z$
205 IFZ$="G"ANDS1=1THENS1=0:GOTO300
210 IFZ$="G"THENL=0:GOTO290
220 IFZ$<>"A"THEN240
230 N=N+1:PRINT"ENTER
TOPIC,PAGE";N::INPUTT$(N,1),T$(N,2):GOTO200
240 IFZ$<>"C"THEN270
250 INPUT"CHANGE WHICH ONE";K:PRINT"OLD (";K;")
";T$(K,1);" ";T$(K,2)
260 PRINT"ENTER NEW TOPIC PAGE
(";K;")";:INPUTT$(K,1),T$(K,2):GOTO200
270 IFZ$<>"R"THEN200
280 INPUT"RESTART WITH WHICH ONE";J:L=0:GOTO180
290 NEXT:S1=1:GOTO200
300 CLS:INPUT"(A)LPHABETIZE OR (M)ENU";Z$
310 IFZ$="M"THEN420
320 IFZ$<>"A"THEN300
330 PRINT:PRINT"SORTING..."
340 FORI=1TON-1:J=I+1
350 FORK=NTOSTEP-1:IFT$(K,1)>T$(I,1)THEN370
360 X$=T$(K,1):T$(K,1)=T$(I,1):
T$(I,1)=X$:X$=T$(K,2):T$(K,2)=T$(I,2):T$(I,2)=X$
370 NEXTK,I
375 CLS:INPUT"SORT COMPLETE: PRESS ENTER TO
LIST";Z$
380 CLS:FORI=1TONSTEP15:
FORJ=ITOI+14:IFJ=N+1THEN410
400 PRINTT$(J,1),T$(J,2):NEXTJ:INPUT"PRESS ENTER
TO GO ON";Z$:NEXTI
410 INPUT"END OF LIST: PRESS ENTER TO GO
ON";Z$:NEXTI
420 CLS:PRINT"ENTER 1 TO START NEW LIST"
430 PRINTTAB(6);"2 TO REVIEW
INPUT":PRINTTAB(6);"3 TO
ALPHABETIZE":PRINTTAB(6);"4 TO LIST OUT INDEX"
440 PRINT:INPUT"WHICH ONE";I
450 IFI<10RI>4THEN440
460 ONIGOTO130,170,330,380
470 END

```


continued from page 25

tional bureaucracies.

In the areas of Visuals, Natural Language Processing and Artificial Intelligence, Norman K. Sondheimer presents a session on "Communicating with Computers in Natural Language—Future Promises." The panelists discuss applications in the fields of office automation, linguistic training for the deaf, medical and legal applications, and military uses now and in the future. The group's focus is on how natural language can be used with computers.

"Single Chip Computers—Where Are They Headed," moderated by K. S. Padda from Texas Instruments, is scheduled for Thursday, May 7, as part of the Hardware and Architecture sessions. Members of this panel include John Hayn from

Texas Instruments, Stan Groves from Motorola and Jim Handy from National Semiconductor. They discuss their perceptions of the future and implications of the single chip microcomputer.

Other activities

In addition to the technical sessions NCC '81 features three theaters showing films on computer technology. Ten hours of films cover computers and communications, computer graphics, the history of computing, and more. Also, plenary sessions in which industry leaders discuss productivity and computers are scheduled. Speakers include Keynote Marisa Bellisario of ITALTEL, Milan and W. Michael Blumenthal, chairman of Burroughs and former Secretary of the Treasury.

System uses on-screen films/slides/videotapes

A new concept for accelerating productivity at the individual employee level has been developed by Bell & Howell's Audio-Visual Products Division in Chicago. The approach provides private, interactive instruction in specific business, industrial, and professional skills via a unique microcomputer configuration designed expressly for this purpose.

"For appreciable pro-

ductivity gains to be realized, management must accelerate and optimize all opportunities for training individual employees," said Bruce J. Frisch, vice president of marketing. "The advent of new microcomputer technologies now makes this both possible and practical."

The heart of the new Bell & Howell system is the ability for a company to tailor specific content

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CIRCLE 28

and to make direct use of previous audio-visual training programs, consolidated into a new interactive system.

Situation simulations

The Bell & Howell instructional system is the first to allow students to teach themselves by responding, with a microcomputer, to simulated job situations displayed on a color TV monitor, the company said. These situations can be generated by the computer itself, video tapes, films, or slides, or any combination of these.

"The net effect is akin to the viewer being able to fully control the content, speed, and presentation of a television detective show according

through methods such as these holds considerable promise of increasing employee productivity, according to Frisch. "There is little doubt that increasing employee productivity will remain among the chief business challenges throughout the 1980s."

Employees' productivity can be increased if a company is able to communicate specific steps employees can take to increase their productivity. The microcomputer is an effective way of accomplishing this training because it gives employees an opportunity to actively participate in their training, and Bell & Howell has found that they learn better and



Accelerated productivity at the individual employee level through individual training is the goal of the new microcomputer-based interactive training system developed by Bell & Howell's Audio-Visual Products Division.

to how he or she responds to clues that are presented," said Frisch. "The sole determinants of how the program proceeds is the learner's ability and comprehension."

Effective training

faster as a result.

In addition, Frisch said, microcomputers free the professional training staff from routine, leading to more effective and productive use of their time for one-on-one interaction or

other management functions.

Special Content

The new training system consists of a proprietary software package called Professional Authoring Software System (PASS). Using PASS, the training program is designed to incorporate specific subject content and to integrate video tapes of audio-visuals as appropriate. Copies of the completed program, on diskette, are then duplicated for the student and instructor. From then on, the student moves at his or her own pace with the system programmed to branch into review or more advanced work based upon the learner's success.

Because of the inherent portability of the microcomputer system, the student can set up "class" in any suitable location—a private office, perhaps, or even at home.

Low Cost

Until, now, employee training generally has ranged between the extremes of uneconomical, on-the-job training of new employees by experienced workers, to various forms of computer-assisted instruction (CAI).

In between are training programs in a central, dedicated facility for large groups frequently composed of people from many geographical areas. The high costs of these programs include loss of the employees' productivity for the period added to travel costs and the expense of

instructional materials and teachers' time.

Only a relatively small number of companies—those found among the Fortune 500 group, for instance—can afford programs of this kind, Bell & Howell said. And even they view such training programs as not very cost-effective, albeit necessary.

According to Bell & Howell, a recent survey has shown that 88 percent of the companies responding do some degree of employee training. The form of this training varies in numbers trained and methods used.

Among computer-based training systems available today are some 30 systems. Many of these are prepackaged, "fixed" systems featuring certain operations such as record-keeping, models of generic plant designs, models of resource allocations and so forth.

How well such existing systems lend themselves to development of individualized programs varies. Some rely on gaming, some on simulation, and some on problem-solving, the company said. The more widely used computer-based instructional programs are frequently tied to large mainframe computers centrally located with terminals in remote locations.

"To achieve a CAI program with a level of sophistication comparable to that of our new system could frequently have depended on shared

continued on page 75

BRAIN GAMES FROM PDI

Tired of shoot-em-up arcade games? Stimulate your brain for a change and have fun doing it. PDI has the best of the word puzzle games by Dr. Dean Victor for Atari*, Apple II* and TRS-80*.

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WORD SEARCH Computer generates word search puzzles using either a Spanish, French or geography word list. Atari version uses color, sound and other special effects, and will even generate printed puzzles for you to do when away from the computer. This is an excellent way for students to practice foreign language vocabulary.

ASTRO-QUOTES This is an anagram-type game. The goal of the game is to guess a famous quotation. Clues are letters that the computer inserts in the correct slots in the quotation when the player correctly guesses the definitions of a series of words.

KROSS 'N QUOTES Quotation guessing game in which the player works against the clock. Player fills in the quote by picking scrambled letters and putting them in place using the joystick.

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CIRCLE 29

May 1981/Personal Computing 63

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Generate Lower Case Characters with Pascal

There are on the market today a number of hardware devices for deriving mixed upper and lower-case characters, both on the CRT screen and via printer. In price, they range from Dan Paymar's lower-case adapter for around \$50 to terminals ticketed anywhere from \$300 to \$400. But UCSD Pascal, implemented in Apple's language system, lets you display lower-case characters without costing you a dime extra. I discovered this rather well-kept secret while browsing through some

of the demo programs on the "Apple 3:" diskette, one of several system diskettes that come with the language card.

Typographers and other specialists whose livelihood depends on the printed word have long known that lower-case text is easier to read than upper-case. You can easily demonstrate this by holding a sheet of paper or a ruler so as to obliterate all but the lower half of a line of characters. Since the eye moves from the bottom upwards when reading, you will be able to distinguish lower-case letters

viewed in this manner more readily than capital letters. Mixed lower and upper case makes for faster reading and assimilation of text and is preferred over all-capitalized characters.

For personal computing, the availability of lower case allows you to annotate games and graphics more attractively. You can mix upper and lower case for the titling of charts and graphs, for legends and captions. You can even enclose lower case in parentheses and use this as a form of "italicized" text.

The accompanying program list-

Program Listing

```

PROGRAM GRFPNT;
USES TURTLEGRAPHICS, PRINTER;
CONST MAXLINES=15;
VAR S:ARRAY[1..MAXLINES] OF STRING;
    X,Y,K,NUMBEROFLINES,D:INTEGER;

PROCEDURE PRINT(ST:STRING);
VAR K,T:INTEGER;
LTR:CHAR;
BEGIN
  X:=0;
  FOR K:=1 TO LENGTH(ST) DO
  BEGIN
    MOVETO(X,Y);
    LTR:=ST[K];
    (* TYPE SHIFT-P AS "SHIFT" KEY *)
    (* TO TYPE CAPITAL LETTERS. *)
    IF LTR='@' THEN
      BEGIN
        K:=K+1;
        LTR:=ST[K];
        WCHAR(CHR(ORD(LTR)))
      END
    ELSE IF ORD(LTR) IN [32..63] THEN
      WCHAR(CHR(ORD(LTR)))
    ELSE WCHAR(CHR(ORD(32+ORD(LTR))));
    X:=X+7;
  END
END;

BEGIN
  WHILE (NOT EOF) DO
  BEGIN
    WRITE('HOW MANY LINES? ');
    READLN(NUMBEROFLINES);
    PAGE(OUTPUT);
    FOR K:=1 TO NUMBEROFLINES DO
      READLN(S[K]);
    WRITE('ARRAY FORMED: <RETURN> ');
    READLN;
    INITTURTLE;
    Y:=180;
    K:=1;
    WHILE K <= NUMBEROFLINES DO
      BEGIN
        PRINT(S[K]);
        K:=K+1;
        Y:=Y-10;
      END;
    FOR K:=1 TO 8000 DO;
      SETDARK(7);
      SETNEGATIVE;
      PRINTPIC;READLN;
      TEXTMODE;
      PAGE(OUTPUT)
    END
  END.

```


ing, GRFPRNT, is very easy to use. It lets you fill the screen with mixed characters when you want to provide a "preface," or introductory remarks, at the head of a long interactive program. You can create files of mixed upper and lower case for saving on a diskette and later use in other programs. By transferring files to the system editor, you can easily make textual changes when required.

Included with the language system supplied by Apple is a diskette with the file name "Apple3:" and on this diskette you will find a code file titled "GRAFCHARS.CODE." Upon execution, this program shows a series of graphics displays, one of which is a screenful of symbols, decorations and alphabetical characters. When I first ran the program, it occurred to me that there might be a way I could assign these characters selectively to strings in a Pascal program and thus come up with software that would

give me immediate access to lower case in my programs.

The key to solution of my problem lay in the Turtlegraphics unit, a library of graphics routines resident in UCSD Pascal when it is implemented. I recognized that the alphabet displayed in the GRAFCHARS program in "Apple3:" was in an array whose elements could be accessed individually and used by means of the ASCII character code—that is, a source code could be programmed that, using read and write statements, would capture and display the characters at the programmer's will.

The result is the program I have called GRFPRNT. The listing as you see it here includes provision for sending the mixed upper and lower-case characters to the printer. If you want to use it solely with the console (video screen or monitor), you can easily modify it by deleting three statements in the main block, begin-

ning with SETDARK (7) and including the statement PRINTPIC. These statements are procedure statements, calls to procedures contained in the library unit PRINTER, which is declared in the "USES" declaration at the head of the program. PRINTER is nothing more than the complete set of "Pascal Printer Parameter" subroutines delineated in the Apple Silentype printer owner's manual. I compiled the entire set of subroutines (procedures and functions) and added them as a unit to the SYSTEM LIBRARY on the "Apple 3:" system diskette.

There is only one subroutine in my program: the PROCEDURE PRINT, which, when called by the main program block, gets the wanted characters from the Turtlegraphics array, using the statement "WCHAR" together with the applicable ASCII codes.

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*** SPOOL/CMD - \$19.95c \$24.95d Parallel port printer spooler, define the buffer size, lines per page, and characters per line, returns use of the CPU while printing is done. Don't confuse this spooler with others that use a disk file, this one spools into RAM memory!

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Languages

continued from page 14

to. Parentheses may be used to denote groupings and the sequence in which the operations are done.

Variables in BASIC may be designated with long names, but in most versions only the first characters are significant. This means that two variables, such as TONE and TOTAL, would both be interpreted by BASIC as TO. Strings are variables consisting of a group of letters or characters. To differentiate between numeric variables and string-variables, a string is ended with a \$ symbol; for example, ST\$ indicates string. In BASIC a constant is simply considered a variable whose value remains unchanged during program execution.

Because of its popularity, BASIC has many admirers and has undergone many modifications to extend its use. No two versions are exactly alike, and thus programs may not be interchangeable. For example, a BASIC program prepared for an Apple computer will not work on a PET or on a Radio Shack TRS-80 if graphics are used. Even though the slight differences are understandable to a nonprofessional programmer, extensive reworking may be necessary to allow different computers to use the program properly.

It's a growing program

Early forms of BASIC were developed to perform with as little as 1K or 2K of memory. For example, Tiny BASIC was an early version that had no string capability, nor could it handle trigonometric functions. Variations of Tiny BASIC could only use integers, and floating-point calculations were not possible.

However, as memory became cheaper, more functions were added to upgrade BASIC. Newer versions of BASIC include both integer BASIC and floating-point BASIC, with the integer generally faster and thus suited for video graphics. With integer BASIC, INPUT statements are followed by a comma, while in floating-point BASIC they are

followed by a semicolon.

These differences can obviously be quite confusing to the novice. The lack of conformity in abbreviations may also pose problems. For example, the PRINT statement is abbreviated by "?" in Microsoft BASIC, "!" in North Star BASIC and "P" in Radio Shack Level I BASIC. To compound the confusion, not all versions of BASIC translate the abbreviation to the complete word when the program is listed.

If abbreviations are avoided, a subset of BASIC commands does exist for most personal computers (see Table). Unfortunately, even though the same command may exist for different BASIC versions, the meaning may be different. For example, the GET command in Apple-soft BASIC orders the computer to read the keyboard for input data; if no key is pressed, the machine waits until one is pressed. After a key is pressed, the computer returns the value of that key. In PET BASIC the GET command tells the computer to read the keyboard; if no key is pressed, the computer immediately returns the value of 255.

Finally, manufacturers of personal computers have designed specific commands for their specialized hardware. As an example, Apple II has several commands for high and low-resolution graphics that are of no use for a different machine.

Speed indicates efficiency

The speed of a BASIC interpreter is a measure of its efficiency. To compare the efficiency of various versions of BASIC, benchmark programs are used.

The user develops a program for an intended application and then runs that program on different computers that employ different interpreters. Of course, modifications must be made on the benchmark program for the various interpreters.

As you know, the interpreter translates every instruction into machine language format and then executes it instantly, with no record

or file. Since many programs include loops that must be repeatedly performed, the interpreter must repeat the translation of each statement each time it recurs, a rather inefficient situation.

However, a BASIC compiler translates the entire user, or source, program into an object, or binary, code for the machine. This can be executed whenever desired. Since the object code can repeat the necessary executions of a loop without need to repeat the translation each time, the BASIC compiler is much faster than an interpreter. The drawback is the difficulty the programmer encounters when modifying or altering statements within the program. Generally the entire program must be translated over again if statement changes are required.

For BASIC programs that are considered fixed, with no changes contemplated, a compiled BASIC is faster than a BASIC processed by an interpreter. For programs that are undergoing changes, revisions or further improvement, the interpreter is the better choice. For the home computer owner, the interpreter is the desirable choice.



An aggressive effort by the Department of Defense to standardize computer languages led to the development of COBOL (Common Business Oriented Language) in 1960. Its acceptance was hastened when the department specified the use of COBOL in many contracts it awarded. Today it is considered the most widespread computer language in the world.

It is intended to handle enormous volumes of business information

entered by accountants and others who did not want to learn a computer language but preferred to state their business problems in a language closely resembling English. For example, there is little doubt to the meaning of a COBOL statement, **MULTIPLY QUANTITY BY PRICE GIVING TOTAL PRICE.** This statement would be converted to the required machine language instructions by a COBOL compiler.

COBOL is used mainly in business applications where large quantities of input and output are required but few computations, compared with scientific applications, where relatively few inputs and outputs require complex steps and calculations.

Extensive files used

Thus COBOL is involved with extensive files in the form of punched cards, tapes or magnetic disks. In applications where complex calculations are included with large

amounts of records and data, it is sometimes necessary to use both COBOL and FORTRAN—separately, of course—to carry out the assignment.

Programs written for business applications—say, a sophisticated tax payroll program—tend to remain active for a considerable time, with only minor modifications needed from time to time. On the other hand, a complex program created for a scientific project may soon become obsolete as technology shifts.

Four elements, or divisions, constitute a COBOL program: (1) Identification, or a name for the source program; (2) Environmental, or specification of the computer that will compile the source program and the computer that will run the object program; (3) Data, or the files to be used or prepared by the program, and (4) Procedure, or the steps that

the computer will perform.

Since each COBOL program has two entries to specify the computer or computers that will compile and run the program, it is possible to compile the program on one machine and run the program on another. Input and output equipment can also be interchanged, so different printers can be used when desired.

Easy to understand

A simple program in COBOL may appear rather detailed, but actually it is easy for a nonprogrammer to understand. The following example shows the addition of 4 plus 5:

```
IDENTIFICATION DIVISION
PROGRAM ID SAMPLE
COBOL
AUTHOR MATTHEWS
DATE WRITTEN
APRIL 6, 1981
REMARKS. SAMPLE
PROGRAM COMPUTES
```

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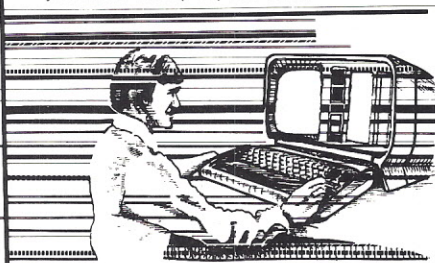
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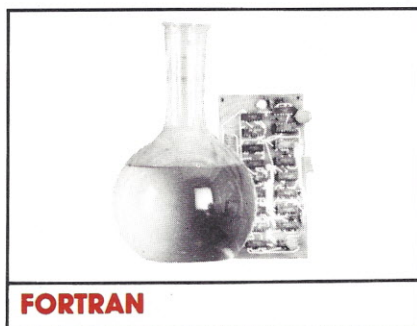


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AND PRINTS SUM OF 4
AND 5.
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SOURCE COMPUTER.
IBM-360
OBJECT COMPUTER.
IBM-360
DATA DIVISION.
WORKING STORAGE
SECTION.
48 NUMBER ONE VALUE IS 4.
48 NUMBER TWO VALUE IS 5.
PROCEDURE DIVISION
CALCULATION, COMPUTER
TOTAL =
NUMBER ONE + NUMBER
TWO
DISPLAY TOTAL. STOP RUN.
END PROGRAM.



An International Business Machines group headed by Jim Backus developed FORTRAN (FORMula TRANslation) in the mid-1950s. The program involved three years of intensive effort, with over 25,000 lines of detailed machine instructions. The language followed a heavy mathematical approach and soon became a powerful tool for scientists and engineers; it was standardized by the American National Standards Institute in 1966.

Although a number of variations of FORTRAN are in existence, it is relatively simple to understand the differences. By today's standards, FORTRAN could be considered unwieldy and relatively inefficient. However, it is quite popular because of the enormous library of engineering and scientific programs available to the user.

Because FORTRAN generally requires a rather large memory and a fast processor for complex scientific problems, it is more applicable to a

16-bit microprocessor with a hard disk than an 8-bit personal computer.

FORTRAN is always compiled, never interpreted, and FORTRAN compilers are available for most computers on the market. Although originally intended for scientific applications, FORTRAN found its way into such areas as business because of the popularity of the language as a teaching tool in colleges and universities. As graduates left and encountered various business problems, they prepared their solutions by using the FORTRAN they had learned. Thus FORTRAN became a language for business applications that do not involve extensive data files.

Although there is no requirement that line numbers appear in a FORTRAN program, they are frequently used. There is no BEGIN or START statement, but the program must be completed with an END statement.

A number in FORTRAN can be fixed-point (whole number) or floating-point (with a decimal point). A floating-point number can be expressed by the number to a power of 10—for example, 3620 can be expressed as 3.62×10^3 or 3.62 E3, where the letter E and the integer following indicate the power of 10.

The operational symbols for FORTRAN are: + for addition, - for subtraction, * for multiplication, / for division and ** for exponentiation. Logical operators are used to compare two terms and provide a true or false result. The logical operators in FORTRAN include: .LT for "less than," .LE for "less than or equal to," .EQ for "is equal to," .GE for "greater than or equal to," .GT for "greater than," .NE for "not equal to," .NOT for "negates," .AND for "both," and .OR for "either."

In FORTRAN, statements are performed in the sequence in which they appear in the program. It is possible to alter the normal sequence by control statements, such as IF or DO. Unconditional control statements, such as STOP or GO TO can

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Disassembled Handbook author Robert M.
Richardson contributed three Basic programs
which allow transmitting and receiving Morse
code at speeds to 40 words-per-minute, without
clockspeedup. Morse appeared in Disassembled
vo. II and III.

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prints beautifully-formatted program listings.

Allen R. Greenburg contributed a professional-
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program, and a Multiplication-Tables Tutor.

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also change the sequence of program execution. STOP is a control statement that halts execution of a program; END is a nonexecutable statement that notifies the compiler that the program is finished. An IF statement orders the computer to proceed to another statement if certain conditions are fulfilled. A GO TO statement instructs the computer to perform a statement other than the next listed statement.

Although FORTRAN is directed toward sophisticated and complex mathematical tasks, the language is not as formidable as one might suspect. Consider the problem $X = C + D$, with $C = 4$ and $D = 5$. The FORTRAN program instructions would be $C = 4$, $D = 5$, $X = C + D$, STOP. The FORTRAN compiler would accept these source instructions and convert them into machine language to solve the equation.

A compiler for FORTRAN is

rather extensive, since it must manipulate many mathematical operations. It must also handle strings of numbers and letters, as well as complicated arrays.

ALGOL

Introduced in 1958, ALGOL (ALGOritmic Language) was intended to be the international language for computer manufacturers and users involved in scientific and mathematical projects. The language was developed through the joint efforts of a German organization, Gesellschaft für Angewandte Mathematik und Mechanik, and an American group, the Association for Computing Machinery. Refinements were made by John Backus, and the altered version was called the Backus-Naur Form. Additional improvements were added until the newer version of ALGOL was unveiled in 1962. The current version is ALGOL 68. A typical program to

add two variables, A and B, could appear as:

```
BEGIN
READ A,B,C
A: = READ: B: = READ;
C: = A + B;
OUTPUT (C);
END
```

The term "read" assigns space in the computer for variables A, B and C. Each executed statement ends in a semicolon. The "begin" and "end" statements must appear in the program.

Because the original form of ALGOL required the use of symbols that were not customary on input and output devices, many computer manufacturers shied away from supporting the language. In addition it was weak in handling character strings, and input/output statements were not an inherent part of the language, requiring procedures to accomplish these needs. In later

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versions of ALGOL there are standard input and output procedures.

ALGOL is much more popular in Europe than in the United States and is considered a powerful tool for complex problems.



A large program is more difficult to prepare than several smaller programs. Large programs can be prepared by use of a series of simple sequences, facilitating the location and correction of errors before the entire program is finished. This is called a structured program. Pascal is one of the few computer languages avail-

able that is designed specifically for structured programs.

Pascal is a high-level language developed in 1970 by Dr. Niklaus Wirth of the Federal Institute of Technology in Zurich, Switzerland. The language is named for the 17th-century mathematician Blaise Pascal, who was credited with developing the first calculating machine. The language demands a clear definition of all variables and constants at the beginning of the program. Thus a programmer is forced to be disciplined as he writes, resulting in a program that is easy to analyze, debug and maintain.

The language, adapted from ALGOL, uses semicolons to separate statements. Like ALGOL, it is block-structured, with programs composed of blocks starting with BEGIN and terminating in END. For clever programmers, Pascal offers the ability to define and manipu-

late types of data other than standard integer, real, array and string. Programs written in Pascal proceed in a logical stream from start to finish, without the abrupt changes associated with other high-level languages. Thus it more closely resembles the way in which a human would solve a problem. For example, a Pascal program to add A and B would be:

```
VAR A,B: INTEGER
READ (A,B)
C = A + B
WRITE LN (C)
```

While BASIC permits variables to be introduced into the program at any point, Pascal demands that all variables be declared at the beginning of the program. A further characteristic of Pascal is that the variables can be any length, with integer, real, Boolean and even user-defined variable types. Sections or sub-units of a long program can be

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written and checked as individual segments before completion of the lengthy program. A segment that computes a single value is called a "function"; if several values are computed, the segment is called a "procedure." The user labels these functions and procedures in the same way that variables are labeled.

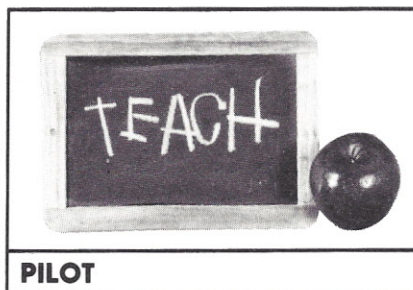
In BASIC, nonexecuted comments are added by use of a REM statement; in Pascal, comments are enclosed in asterisks or parentheses. Statements are separated from each other by a semicolon, except for the output statement and the END statement, which closes with a period.

The language is simple and efficient, and its compiler is not complex. Pascal is an attractive alternative to BASIC for users of mini-computers and microcomputers. One drawback is the tendency to require more than 20K memory at a time when 16K computers are relatively popular.

PL/1

When PL/1 (Programming Language 1) was introduced in 1965, many computer experts predicted rapid popularity and acceptance for it. The design was tailored to include the most desirable features of FORTRAN, ALGOL and COBOL and thus offer considerable versatility. But PL/1 never achieved the predicted acceptance, not because it didn't attain the high design goals, but rather because of the sheer complexity of the language. For most applications, it is too extensive; as many as 200 keywords may be required for a typical application.

Nevertheless PL/1's ability to handle scientific problems has enabled it to compete with FORTRAN, with PL/1 far superior for nonnumeric data.



Developed at the University of California in San Francisco Medical Center, PILOT (Programmed Inquiry Learning Or Teaching) was originally intended for introducing children to the fundamentals of computer performance. The original version, called CORE PILOT 73, was most often used for computer-aided instruction, where its interactive capability could come into play. PILOT is a language especially tailored for such instructional tasks as drills, tests, dialogues, etc., and it is convenient for allowing comparisons between words or portions of words. However, it is relatively poor for execution of complex computation problems.

A PILOT program contains a series of statements that outline the steps the computer takes to interact with the user at the input keyboard. The type of statement and its function (the instruction code) is given by one or more letters followed by a colon. The core instructions are single-letter codes that appear in all versions of PILOT. They include:

T: TYPE U: USE
A: ACCEPT E: END
J: JUMP C: COMPUTE
M: MATCH R: REMARK

An elementary PILOT program could be:

T: ARE YOU FAMILIAR
 WITH PILOT?
A:

M: YES, NO, RIGHT,
 WRONG

TY: THEN YOU DON'T NEED
 EXPLANATION

TN: BETTER FOLLOW THE
 INTRODUCTION

The code T indicates "type text," A indicates "accept an answer," with M requesting a "match." The Y and N following the T are conditioners, depending on the match given. If the answer to question A is YES, the computer will respond with THEN YOU DON'T NEED EXPLANATION. However, if the answer A is NO, RIGHT or WRONG, any of which is incorrect, the text BETTER FOLLOW THE INTRODUCTION will be displayed.

Instructional programs using PILOT can be designed to allow the user to respond with conversational replies, as shown by the above example, and then have the response matched to a proper keyword.

LISP

In many ways, LISP (for List Processing Language) is completely different from other high-level languages, because it was developed for nonnumeric applications, with strong emphasis on recursive, or repeating, functions. Created in 1959 by John McCarthy at the Massachusetts Institute of Technology, the language is directed toward the list structures and notations. LISP programs are a series of function definitions in the form of an expression, followed by the functions under evaluation.

In the two main versions of the language, EVALQUOTE-LISP and EVAL-LISP, some functions take on different meanings for each version, and each system may not include the same functions.

Comparing instructions in six languages

BASIC	ALGOL	COBOL	FORTRAN	Pascal	PL/1
PRINT X	PRINT (X)	DISPLAY X	PRINT *,X	WRITE (X)	PUT LIST (X)
INPUT X	READ (X)	ACCEPT X	READ *,X	READ (X)	GET LIST (X)
LET X = 4↑2	X: 4↑2	COMPUTE X = 4**2	X = 4**2	X = 4*2.4*2	X = 4**2

The words of LISP are alphanumeric or numeric quantities called atoms. Some versions of LISP require atoms to begin with a letter, while other versions permit character strings. Lists can also be considered words in the LISP language and are constructed from atoms.

ADA

The most recent candidate for a universal language is Ada, based on a concept that various software components can be selected from a catalog and then combined via a common bus for any custom application.

The project to develop a language that could be applied for business, science, math and other uses was initiated by the Department of Defense in 1975 when it became clear that a single, portable, easy-to-learn language could save hundreds of millions of dollars annually. The language that Jean Ichbiah devel-

oped includes the most desirable features of Pascal, ALGOL and PL/1. The high-level language is named after Augusta Ada Byron, daughter of the poet Lord George Byron. She is considered to be the first programmer because of her work on Charles Babbage's Difference Engine, an early type of computing machine developed for logarithm table entries.

The Ada compiler permits an assortment of software components to be connected to it, just as a module might be plugged into a hardware bus on a computer. This feature allows Ada to be customized for a wide variety of applications while being compatible at the same time with other existing software components.

Getting the act together

Even when a common high-level language is agreed upon by a group

of users, a great deal of confusion may exist because of the different versions available. A FORTRAN program written for a computer supplied by manufacturer A may have only slight variations from a FORTRAN program written for manufacturer B's machine; but even one slight variation could prevent the computer from functioning properly if the programs were interchanged.

A major effort to organize the users of a similar programming language is being undertaken by the American National Standards Institute (ANSI). This organization represents over 900 companies and 200 professional and business establishments; it does not develop standards but rather encourages capable groups to make the effort. Further, it clarifies what standards are needed and suggests the time frame for the standardization effort. □

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Personal Computers

continued from page 55

primary unit consists of a keyboard/MPU, which includes 4K of RAM and Color BASIC, an enhanced version of Level I (or, if you wish, a slightly scaled-down version of Level II) BASIC. The keyboard unit attaches to any black and white or color television set, and includes provisions for one tape recorder, two joysticks, a serial (RS-232) printer, and Read Only Memory program packages. Packaged software, which may be plugged into the side of the machine, takes over the computer when it is powered up. A few early entries are currently available with the promise of many better programs to follow.

TRS80C Enhanced Color BASIC, written by Microsoft, could turn out to be one of the most powerful BASICs designed for a personal computer.

A powerful language, combined with the yet-to-be announced expansion devices such as disk drives, could make the TRS80C one of the most popular of the new breed of home computers. The 4K Color Basic version is priced at \$399. The primary configuration can be officially expanded to 16K of RAM. Extended Color BASIC is an additional \$99, and it requires the 16K memory kit priced at \$119.

Texas Instruments' 99/4

In June 1979, Texas Instruments introduced its TI 99/4 personal computer at the Consumer Electronics Show in Chicago. The machine was anxiously awaited by the personal computer industry but its calculator-style keyboard has prevented it from becoming popular with the general public and the unit has been having a hard time becoming accepted.

The TI 99/4 has a 40-key keyboard, 26K of internal ROM and 16K of RAM. It uses the TMS 9900 microprocessor which makes it the only 16-bit machine designed for home use. The system features color graphics, music capabilities and pro-

grammable sound effects. ROM Solid State Software Command Modules may be plugged into a slot in the keyboard chassis; module programs use up to 30K of ROM.

The 99/4 can address up to 72K of memory: 16K RAM, 26K of internal Read Only Memory and up to 30K of ROM in the form of the command modules. The internal ROM contains 13-digit, floating point TI BASIC. TI's BASIC includes color graphics commands, as well as the ability to generate sound and music, and has 24 BASIC statements and 14 commands. Recently an extended BASIC for the 99/4 has become available.

Another capability of the computer is speech synthesis through the use of TI's solid state speech synthesizer. The accessory comes with a

200-word vocabulary and it allows you to have the computer give verbal prompts under program control.

Software, available on either cassette tapes or the command modules, includes: general purpose list management, financial record management, accounting, stock market analysis, education modules and games featuring high resolution graphics from both TI and Milton Bradley. Prices for the software range from \$20 to \$70.

In addition to the speech synthesizer, a number of peripherals are available from TI to include mini-disk drives, disk drive controller, thermal printer, telephone modem, RS-232 serial interface and an RF modulator for connecting the computer to a user-owned television. Price for a typical system is \$650. □

Need more information?

For more information on individual small computers systems, readers may contact the manufacturers listed here by circling the appropriate numbers on the reader-service card.

Apple Computer Co., Inc., 10260 Bandle Dr., Cupertino, CA 95014; (408) 996-1010. *Circle No. 175*

Atari Consumer Division, 1265 Borregas Ave., P.O. Box 9027, Sunnyvale, CA 94086; (800) 538-8547. *Circle No. 176*

Commodore Business Machines, Inc., 3330 Scott Blvd., Santa Clara, CA 95051; (408) 727-1130. *Circle No. 177*

Heath Company, Zenith Radio Corp., Hilltop Rd., St. Joseph, MI 49085; (616) 982-3200. *Circle No. 179*

Hewlett-Packard Co., Corvallis Division, 1000 NE Circle Blvd., Corvallis, OR 97300; (503) 757-2000. *Circle No. 180*

Ohio Scientific, Inc., 1333 S. Chillicothe Rd., Aurora, OH 44202; (216) 562-5177. *Circle No. 183*

Osborn Computer Corp., 26500 Corporate Ave., Hayward, CA 94545; (415) 887-8080. *Circle No. 184*

Radio Shack Division, Tandy Corp., 1300 One Tandy Center, Fort Worth, TX 76102; (817) 390-3011. *Circle No. 185*

Texas Instruments, Inc., U.S. Consumer Products Group, Personal Computer Division, 2301 N. University, Lubbock, TX 79415; (806) 741-2000. *Circle No. 187*

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use of a company's main-frame computer," Frisch said. He estimates that the cost of this could be well over \$100,000 in equipment and programming time. The leasing cost of PASS will be \$5,000 per year. The Bell & Howell Microcomputer 3048D with 48K byte random access memory (RAM) required to utilize PASS, plus

associated hardware, costs about \$4,000. The microcomputer can also serve as a word-processing and problem-solving system.

For more information on the new microcomputer-based learning system, contact Bell & Howell, Audio-Visual Products Division, 7100 McCormick, Chicago, IL 60645; (312) 262-1600.

Programs to aid The handicapped

A nationwide search for ideas and inventions through which personal computing may be used to aid the handicapped is now underway, sponsored by grants from the Radio Shack division of Tandy Corporation and The National Science Foundation.

Entrants in the competition, which will be conducted by Johns Hopkins University, are eligible for awards including a \$10,000 grand prize given by Radio Shack, a TRS-80 and other computer systems, and more cash prizes. Over 2,300 participants have already submitted applications.

Computer-related ideas, devices, methods and programs to help handicapped people overcome difficulties in learning, working and successfully adapting to home and community settings are the objective of the search.

"Upwards of 40-million Americans are considered as being handi-

capped, according to government figures," said Tandy vice chairman Lewis Kornfeld, explaining his company's special interest in the program, "and we know the personal computer can affordably help large numbers of them."

Among the categories that may be addressed by entrants are computer-based aids for the blind, deaf and mentally retarded; for individuals with learning disabilities, neurological or neuromuscular conditions; and the orthopedically handicapped.

Paul L. Hazan, director of the Personal Computing to Aid the Handicapped project at Johns Hopkins, said that entries are being sought from computer specialists and professionals, full-time high school and college students and amateurs or interested people generally, including those with handicaps.

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the inventors and developers to make contact and for partnerships with the handicapped in a way that can lead to wide acceptance and use of the new computing technology," Hazan said.

Orientation meetings are being scheduled at major rehabilitation centers throughout the United States to bring together potential inventors, handicapped people and professionals in habilitation-rehabilitation fields. Members of the Association for Computing Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE), and personal computer clubs

are participating actively in these preliminary meetings.

Contestants have until June 30, 1981 to prepare and submit their entries. National awards will be presented at a banquet in the fall of 1981 in Washington, DC.

Additional information, including a descriptive flyer and contest application, are available by writing to: Personal Computing to Aid the Handicapped, Johns Hopkins University, P.O. Box 670, Laurel, MD 20810, or from the more than 6,000 Radio Shack stores, Computer Centers and participating dealers, nationwide.

News service for Atari Owners

Dow Jones & Co., Inc. has announced plans to provide its News/Retrieval Service for owners of Atari personal computers. The Dow Jones service provides current and historical stock price quotations, and business and financial news and information on command through personal computers and standard time-sharing terminals.

Using the Atari Telilink TM-1 communications cartridge program, users and passwords can access the services through a series of simple commands typed in at the keyboard. Information is retrieved by company stock symbol, industry or government agency, and other special subject category codes.

With a suggested retail price of \$29.95, Telelink TM-1 is designed for both business use and individuals with a need for up-to-date financial information, the company said.

A second joint software package, the "Dow Jones Investment Manager," is currently under development by Dow Jones and Atari and will allow the user to easily and quickly store, analyze and graph portfolio and investment information retrieved from the Dow Jones News/Retrieval Service. It will be contained on a diskette that stores instructions for the computer. The Investment Manager will be available through Atari personal computer dealers later this year. □

Compilers

continued from page 42

translates each of your instructions (your *source program*), performs the action required and goes to the next instruction. A computer working in a compile mode, takes your source program, translates and optimizes it, and then generates an object program that it can understand more directly than your instructions.

Advantages to each

If a compiler has the advantages of speed and optimization of instructions, why would anyone bother with an interpreter? Actually there are some excellent reasons for working with an interpreter instead of a compiler. For one thing, the interpreter is interactive—that is, you can work with it easily. Let's go back to your foreign-speaking employee.

You've noticed that the new clerk is so efficient and exacting when he understands what you want done that you decide to let him do as many jobs in your company as possible. The only problem with the idea is that every new job you have the clerk perform will require a new set of instructions, and these must be both explicit and translatable.

If your clerk is working with an interpreter, you can stop him at any time, change an instruction card, let him resume his task and watch to see if the job is coming out right. You can work with the employee easily, because you can change your instructions at will. When the clerk

gets to a new directive, he has it translated and performs it immediately—you have instant feedback.

If the clerk is working with his book (his object program), however, you will find interacting with him a little more difficult. For one thing, you can't understand the language in which the book is written, so you can't make changes in the book yourself. If you tried, you might change the wrong thing with unexpected results. Secondly, because your compiler worker translated everything at one time and also drew a map to show the clerk where everything is, making changes in the book might invalidate the instructions or mess up the map's orientation.

The only way to change the instructions for a clerk working with the help of a compiler is to change the directions in your original stack of cards and then have the clerk go through the entire compile process again. Making even minor changes under these conditions becomes a time-consuming chore.

One other aspect of your clerk has to be taken into account when you decide whether to help him with an interpreter or compiler—the quantity of cards he can carry. As the total number of cards that your clerk can carry is constant, he can hold either many all-English cards or some English cards and some translated cards. The total number of

cards, whether one of a kind or a mixture of both, cannot exceed his card-carrying limitation. Therefore if your English card instruction stack is large, the clerk might not have the strength (computer memory) to carry both the English cards and the translated cards to the duplicating department.

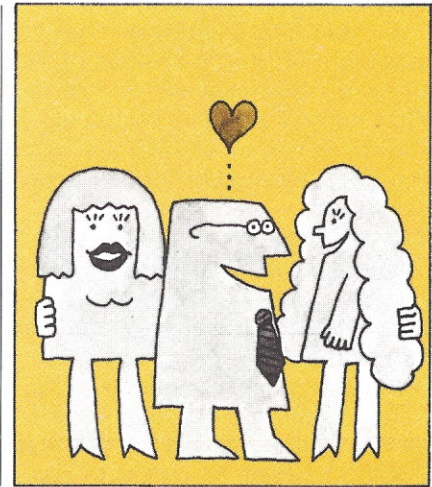
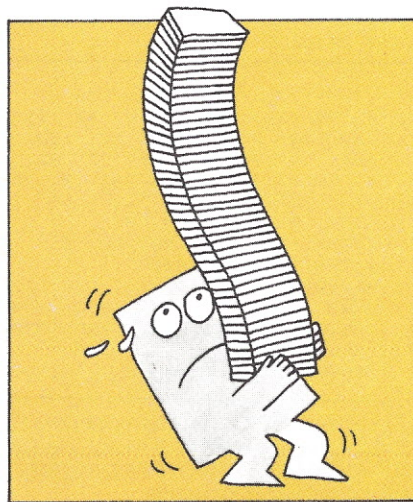
Two ways to handle errors

As hurried as most employers are, mistakes usually come up with designing a set of instructions for a new job. A clerk working with an interpreter treats such mistakes on your part differently than a compiler.

The clerk with the interpreter will stop as soon as he comes to an instruction that can't be translated, because he doesn't know what to do next if he doesn't understand what you're trying to tell him. The interpreter doesn't know about mistakes until the clerk gets to the card with the error on it.

A compiler, on the other hand, translates the whole set of instructions, making notes on all the instructions that don't make any sense and notifying you that you have to change the instructions. Once you make all the corrections, the compiler begins the translation process all over again, looking for new errors. If there are none, the new object program is acceptable and can be written out for use later.

As you may have determined by



this point, the most efficient way to get things done in the office is to combine the best features of both modes of operation. If you are developing a new set of instructions that will enable the clerk to perform a certain task, your best bet is to work closely with the clerk and the interpreter until the clerk is getting the job done exactly as you want him to do it. If you encounter problems along the way, it is a simple task to alter your instructions until you achieve the effect you want.

But once the clerk's stack of cards gets the job done efficiently, you can then send him to the compiler to have the cards made into book (object) form. In this way, you've used the interpreter to work the errors (bugs) out of your instruction set, and you gain the added speed that the compiler provides when everything is running smoothly.

The real world

In the real world of personal computers, the application of some of the principles covered in the scenario of the clerk in an office varies to some degree. All of the "packaged" personal computer systems on the market today use the interpreter mode of operation. Because of the speed and efficiency advantages offered by compilers, however, compiler programs are being developed for personal computers. With the relatively limited memory available on personal computers, these programs vary in the way they implement compiler operation.

To show the differences between compilers, let's look at some of the programs marketed for two of the most popular personal computers—Radio Shack's TRS-80 and the Apple Computer Co.'s Apple computer.

Tiny Comp

The Tiny Comp program from Ramware is a BASIC compiler, written in TRS-80 Level II BASIC for 16K to 48K TRS-80s. The compiler program, which occupies approximately 3200 bytes of memory, has to be attached to the end of whatever BASIC program you want to com-

pile. To add the compiler program to your BASIC program, you can use one of three methods: (1) Key in your program and then key in the listing for Tiny Comp; (2) Load Tiny Comp and then key in your program (be sure that the line numbers for your program are lower than the ones Tiny Comp uses); or (3) Load either your program or Tiny Comp and merge the loaded program with a program you bring in from the cassette or diskette. The BASIC compiler listing uses lines 800 through 5210; you can use line numbers 1 to 799 for your program or you can renumber the compiler lines to a higher series.

To use Tiny Comp, you establish protected memory in the TRS-80, load your program with the compiler coding attached and RUN your program to be sure there are no bugs. When you want to compile, you issue a <RUN 1000>. Tiny Comp takes over and POKES the object code into the high memory you protected. As the compiler works, the video display shows the BASIC program's decimal line number, its POKE address and the machine language code for each line compiled (Fig. 1).

Tiny Comp comes in both tape (\$19.95) and disk versions (\$24.95), with the tape version actually offering more capabilities. In the tape version a compiled program can be saved with a program provided with the compiler; disk users have to recompile a program each time they want to use it.

Although the games that come with the program ("Tic Tac Toe" with the tape version and a thing called "Splat" on disk) are impressive in illustrating the speed difference between BASIC and machine language, Tiny Comp's use as a compiler is severely limited because of its very small instruction set. The compiling program is also very slow—the "Tic Tac Toe" game, which is about 4000 bytes long, takes 14 minutes to compile.

This program could be of interest to computer buffs who are fairly familiar with some of the more sophisticated aspects of programming and who wish to analyze how the compiler works, or for persons who are capable and can program complex programs using a very limited number of operations. If you are a general user who wants to put any old BASIC program on a TRS-80 and have it compiled, Tiny Comp is not for you; it is more of a learning tool than a general-purpose compiler.

ZBASIC

The ZBASIC compiler from Simutek is available for 16K to 48K TRS-80s. The tape version sells for \$99; the disk version is \$129. As with Tiny Comp, the documentation (instructions) with the package presupposes that you understand how to program in Level II BASIC.

One of ZBASIC's strong points is that it is an interactive compiler. You can jump back and forth between your source code and the object pro-

```

127 235 115 225 233
* 790 -31450 : 22 2 30 117 235 34 210 127 42 210 127
22 60 30 0 25 22 133 30 64 235 205 158 127 24 8
60 69 78 84 69 82 62 34
* 792 -31416 : 205 43 0 38 0 111 34 210 127 22 0 30
13 235 34 214 127 42 214 127 235 42 210 127 183
237 82 202 10 0
* 794 -31386 : 195 24 3
* 799 -31383 : 201
ADJUSTING JUMP'S . . . 22 22 90 30 650 600 750 740 790
200 200 200 380 650 650 600 750 700 110 610 602
652 750 705 720 725 730 735 715 715 715 742
746 10 792
<ENTER> TO =RUN= MACHINE CODE . . . ? ←

```

(1) Output from Tiny Comp shows the BASIC program's line number, the POKE address and the machine-language code of the BASIC line. The compiler also displays its progress while adjusting jumps. Hitting Enter runs the compiled program.

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gram that the compiler creates. To do this, you have to add one line of programming code to the program you want to compile, because the <BREAK> key does not work with compiled programs. The instructions show you what to add and how to do it.

To operate with ZBASIC, you power up the computer, set aside protected memory and load the compiler program under the TRS-80 System command, if you have a cassette-based computer, and directly from the Disk Operating System (DOS) if you have disks. The next steps are to load or key in a BASIC program, check it for bugs and add the special line of coding.

When you are ready to compile, you either type <X=USR(0)> or <SYSTEM> and then </22528>. The compiler takes over and makes three passes through the BASIC program, notifying you of each pass.

The first pass stores strings, data, etc. The second pass does the compiling and the third adjusts GOTOs and GOSUBs.

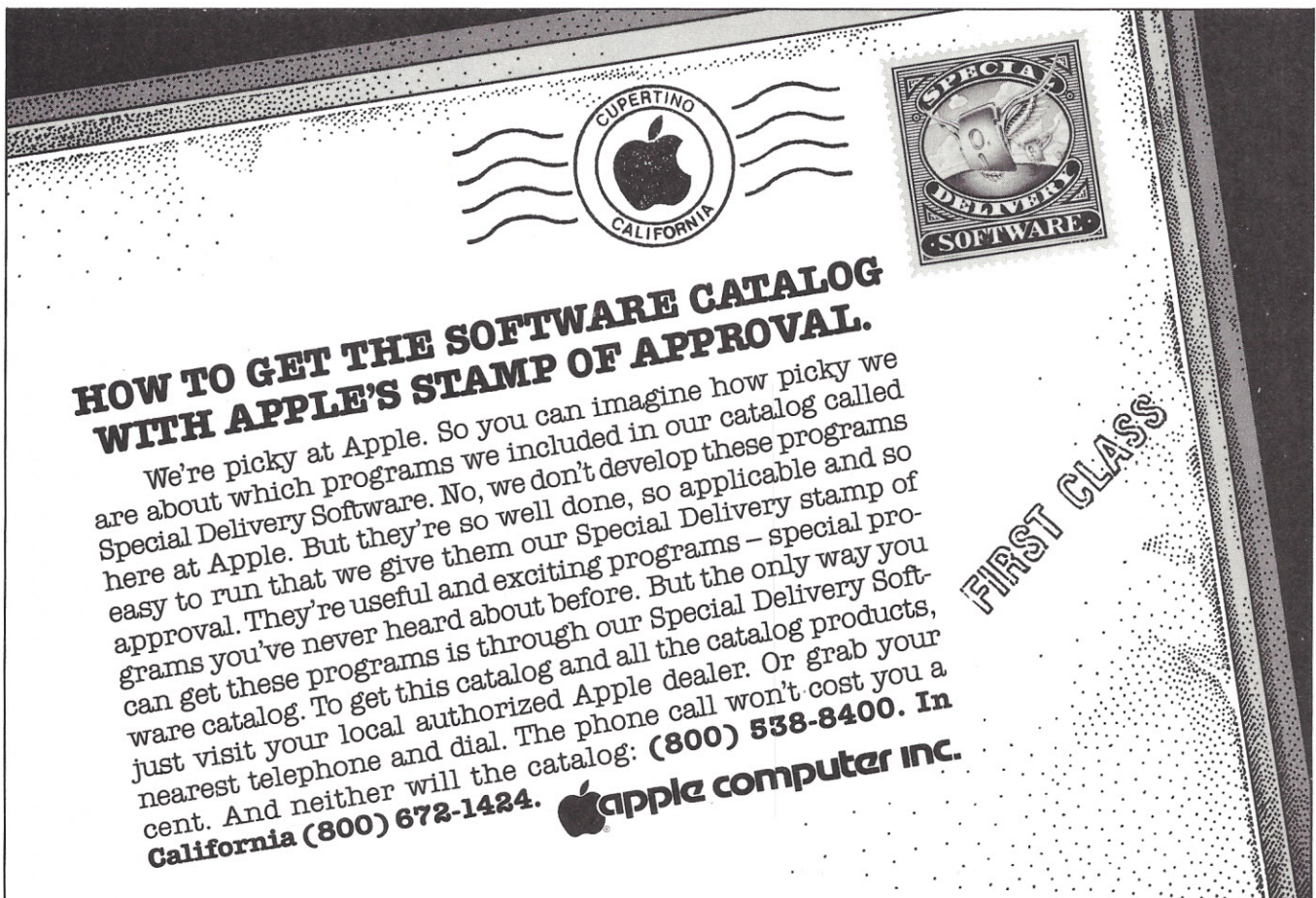
There are limitations

If there are no compile time errors (ZBASIC returns to BASIC if errors are detected), ZBASIC's menu (choice of options for the user) appears on the video. From the menu, you can run the compiled program, return to BASIC or save the compiled program on tape or a diskette. Each of the operations takes a single key entry. Hitting the "S" key saves the compiled program and returns you to the menu.

In addition to not recognizing the direct commands of the computer (such as LIST, RUN, AUTO, TRON, etc.), which cannot be used within your BASIC program, ZBASIC also disallows use of disk file commands, such as OPEN, CLOSE, EOF, thereby eliminating

the compiling of BASIC programs that involve disk input and output. The lack of direct command support isn't much of a hindrance, however, because you generally use those commands while programming. But the lack of disk input/output (and DIM) eliminates compiling the complex programs that benefit most from compilation. The inability of ZBASIC to compile the reading of programs from strings from DATA statements also limits the programs that can be compiled.

The limitations of ZBASIC mean that many of the programs you try to compile probably won't. If you're fairly sophisticated in BASIC programming, however, you may be able to get a program working and compiled. The documentation provides many short programs that help you get around some of ZBASIC's limitations.



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ACCEL and ACCEL2

Developed in Britain by Southern Software and distributed in the United States by Allen Gelder Software, ACCEL and ACCEL2 come close to what might be considered general-purpose compiler programs. General purpose means that you can take a BASIC program and compile it without worrying too much about the coding in the program. ACCEL (\$44.95) is designed for Level II BASIC; ACCEL2 (\$88.95) compiles Disk BASIC as well as Level II.

Compiling a BASIC program with the ACCEL compilers results in a program that is a mixture of BASIC statements and directly-executing machine instructions for the Z80 (the TRS-80's microprocessor), because both the tape and disk use a technique of selective compilation. For instance, INPUT statements aren't translated at all but remain in the compiled program in their source form and are executed by the computer's interpreter. With the exception of SET and RESET, ACCEL confines its translation to those operations that can be expressed as machine code, but ACCEL2 translates many statements to sequences of calls to routines in the computer's read-only memory (ROM) or to routines in ACCEL2's run-time component.

The technique of using both interpreter and compiler characteristics results in some interesting benefits. It allows the compiler programs themselves to remain small (2816 bytes for ACCEL and 5120 bytes for ACCEL2). It's easy to break out of a running compiled program (you hit the break key and wait for it to "catch" on one of the BASIC lines still in the program). And, in the case of ACCEL2, you can compile selected portions of the program.

When a BASIC program is compiled, it may expand beyond the memory size of the computer. In most cases only a small part of a program is responsible for most of the execution time. With ACCEL2, you can compile a program's vital sections and let the machine's interpreter handle the rest of the code. Charts in the documentation show you where the greatest benefits lie.

If you do have problems compiling a program, you can use selective compilation to break the program into smaller and smaller pieces until you get the offending part to compile. To save a tape version of a compiled program, you must have Southern Software's TSAVE program, which sells for \$9.95.

Microsoft BASIC compiler

Microsoft's two-diskette BASIC Compiler (\$395, Model II; \$195, Model I) offers both general users and advanced computer programmers benefits not found in some of the other packages. This compiler, unlike the previous ones, operates only on a full 48K TRS-80 with at least one disk. A two-drive system is better, and a three-drive system is ideal.

Probably the two most important aspects of the Microsoft package are its efficiency and ease of use. If you can read step-by-step instructions, compiling a pro-

continued on page 110

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What does interactive mean? It means you have ZBASIC and your BASIC program resident at the same time! You may compile a BASIC program, run it or save it without destroying your resident BASIC program! In fact, jumping back and forth between the compiled code and the BASIC code is one of its finest features!

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FACTS ABOUT ZBASIC

1. 16K ZBASIC will compile a 4.8K program. (tape only)
32K ZBASIC will compile a 17K (tape), 10K (disk) pgm.
48K ZBASIC will compile a 17K program. (disk only)
(These are approximate values depending on program efficiency etc.)
2. ZBASIC DOES NOT support disk or tape files.
3. BASIC programs compiled with ZBASIC are between 10-200 times faster than interpreted BASIC!!
4. NO ROYALTIES ON ZBASIC COMPILED PROGRAMS!!
5. ZBASIC programs are only about 1.1 times larger than the average basic program.
6. ZBASIC programs may be used as USR routines from basic.
7. ZBASIC uses INTEGER MATH ONLY to increase speed and decrease compiled program size. Use of Single or Double precision would destroy the beauty of the first "INTERACTIVE COMPILER" on the market!
8. Limited variables: A-Z, A1-Z1, A2-Z2, A\$-Z\$. Arrays are not supported to decrease memory demands and speed up compiling of programs.
9. COMPILE TIMES ARE TYPICALLY 1 TO 10 SECONDS! THERE IS NO NEED TO USE COMPLICATED COMPILE TIME MODULES!
10. ZBASIC comes with a HIGHLY DETAILED manual describing all important memory locations, commands, variables, warm/cold start entry points and many useful sub-routines for emulating unsupported commands!!
11. Existing programs may be loaded from tape or disk and compiled as long as unsupported commands or variables are not used.

ALL COMMANDS DIRECTLY SUPPORTED BY ZBASIC

FOR	NEXT	STEP	IF	THEN	ELSE	PEEK
SET	RESET	POINT	CHR\$	RANDOM	RND	POKE
DATA	READ	RESTORE	END	GOTO	GOSUB	CLS
INPUT	INKEY\$	LET	STOP	OUT	INP	RETURN
PRINT	LPRINT	PRINT@	USR	SGN	INT	ABS
SQR	LEN	ASC	VAL	STR\$	POS	ON GOTO
ON GOSUB	REM	NOT	AND	OR		
INTEGER MATH *MULTIPLY /DIVIDE †ADD -SUBTRACT ‡ — 32767						

NOTE: Some commands do not act exactly as BASIC commands act

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Operating Systems

continued from page 32

more informative.

What makes the lack of error messages particularly aggravating is that most uses of the operating system are indirect rather than direct. Normally, unless one is a systems programmer, access to the operating system will be via some applications program—an inventory control program or a word processor. These programs rely on the operating system to do their file access. Should there be a disk read error, the user may be left to puzzle out whether it is the software, the operating system or the hardware that is at fault. The Oasis operating system, on the other hand, has a comprehensive set of error messages that is the equal of any available on a mainframe computer.

CP/M's documentation is also woefully inadequate. The manuals lack indexes and are written in a style that is cryptic in the extreme. Many of CP/M's most powerful features are not documented at all but relayed from one user to another by word of mouth. Recommended reading is *The CP/M Handbook* by Rodney Zaks, published this year by Sybex of Berkeley, Calif., at \$19.95. Here is a manual for CP/M that will, in the author's words, "take you by the hand" and lead you from feature to feature. There is an excellent index, too, for those who may want to skip portions of the tour.

A word of caution

One of CP/M's idiosyncrasies that could lead to disaster is that it will not permit the user to switch diskettes in a drive, unless the system is rebooted. Without a reboot, CP/M may return with a read error—or, worse, it may overwrite the disk's directory. Should the latter occur, the user loses access to every single file on the disk irretrievably!

Fortunately for Cromemco and Quay owners, those manufacturers have modified their versions of

CP/M to forestall such a crash. Others should consider purchasing DISK UTIL, a file recovery disk utility system from the Software Store, 706 Chippewa Sq., Marquette, MI 49855.

There are alternatives

CP/M's use is no longer limited to traditional Z-80-based computers like the Quay, Heath, North Star Horizon, and Cromemco. Apple owners may purchase hardware (Microsoft's Softcard) that provides a Z-80 environment for CP/M. And CP/M may be purchased for Radio Shack's Model I and Model II computers. Apple and Radio Shack owners also have other alternative operating systems.

TRS-80 operating systems

If you are still using a Radio Shack operating system released prior to May 1979 (Version 2.1 or earlier) run, do not walk to your nearest Radio Shack outlet or telephone the engineering department in Fort Worth (817 390-3011) to get immediate replacement. The reason: Radio Shack's first operating system was poorly prepared. Owners have two other alternatives to the TRSDOS supplied with their machine: they can upgrade to NEWDOS, UltraDOS or LDOS.

NEWDOS, a product of Apparat, Inc., is a rich, flexible system. Unfortunately its manual is too detailed—every last option is documented. Take the Format command: "FORMAT, dn2[=tc2], name2, mm/dd/yy,password3[,N][,Y,] ND-MW,DDND,ODN-name1,KDN,DDST=tn1,DDGA=gc1".

Actually this command is not as intimidating as it looks once one has mastered the mnemonics of earlier pages. But contrast it with the leisurely approach of TRSDOS (version 2.2):

```
FORMAT
which drive is to be used?
1
```

diskette name?

MANUAL

creation date?

10/08/80

and so forth, a step at a time until the command is entered in its entirety.

UltraDOS also takes a leisurely approach in this instance, although its manual complicates the procedure with much unnecessary verbiage. Incidentally, in CP/M the command takes the form FORMAT, with no options whatever, and it is used only once to adapt a disk for use with a particular computer.

LDOS from Lobo Drives International is a recently announced disk operating system that can support up to 8 drives. A powerful feature of LDOS is that it can mix 5 1/4- and 8-inch drives, double-sided drives, double density drives as well as 5 1/4- and 8-inch Winchester fixed disk drives in any combination. Other features include built-in lower case display drivers, ISAM accessing techniques for rapid searching, keyboard type ahead and more.

Model II owners would do well to purchase CP/M just to take advantage of all the compatible software that is available.

Apple operating systems

Apple's disk operating system was never quite as bad as Radio Shack's worst, but it is slow and memory-consuming. The latest version, however, does require less RAM and provides for an increase in storage on a 5-inch diskette from 116 to 143 kilobytes.

Apple II owners now have two available options: CP/M at \$350 for both the hardware and software, or Apple Pascal, which may be purchased from any Apple dealer for \$495. Apple Pascal is by far the better buy, because of its efficiency and ease of use.

When the Apple II was first introduced, it was configured around the

built-in BASIC and also had facilities for tape storage. The operating system was designed accordingly. However, the demand for disk storage meant that Apple had to come up with a disk operating system (DOS). Of course, Apple had already committed itself to ROM-based BASIC and had to construct the DOS around this. The result was somewhat of a kluged together operating system.

Apple II DOS has been available in about a half dozen different forms since its introduction. In essence DOS continually monitors the stream of characters that the user's program sends out to the video screen via the PRINT command. One character (control-D) has been designated to "wake-up" the DOS and tell it that the characters that follow make up a disk command. These commands are normally used to manage files, and

take the form of OPEN, CLOSE, READ, WRITE, LOCK, etc., followed by the name of the file on which the operation is to be conducted.

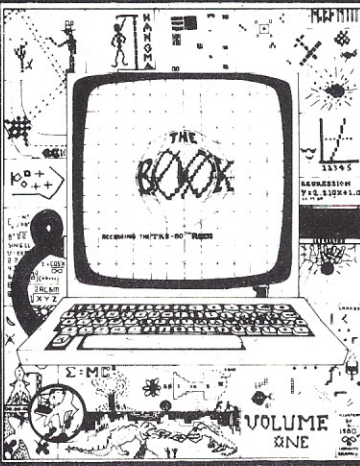
This type of system, although easy to understand (which in many ways accounts for the popularity of the Apple II) is not ideal by any means. Occasionally the DOS may without warning wake up and wander off to look for an unintentionally called file. This may occur if you happen to be working on a mailing list and enter the city name "READING". The DOS will think that you are telling it to "READ" a file called "ING". Entering the word "EXECUTIVE" may cause it to search for a file called "UTIVE".

But even with these inconveniences, the Apple's operating system does give the programmer a host

of built-in features that are readily supported. These have more than compensated for the "backward" approach of its design. It is interesting to observe, moreover, what Apple can come up with when it deliberately sets out to design a total system, knowing at the inception what the final product is required to do. The result is a system known as SOS.

SOS to the rescue

SOS, or the Sophisticated Operating System, is well-named. Where the Apple II operating system evolved from the top down to meet the demands of a changing market, SOS, currently installed in the Apple ///, has been designed from the bottom up, with the goal of consolidating all future Apple products to a common software base—the operating system. Since SOS has been designed to operate with virtu-




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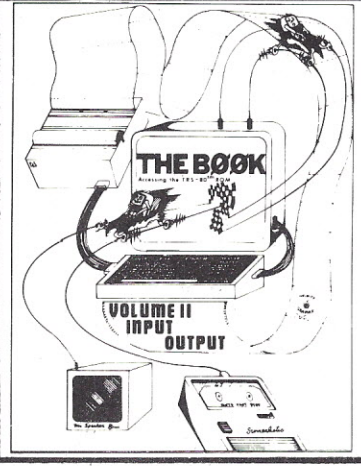
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VOLUME II

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ally any microprocessor, whether a 6502 or a 68000, future users of Apple products will be able to upgrade their hardware without conceding their investment in software.

SOS is entirely a disk-based system, and it is loaded into the computer when the power is first turned on. This means, of course, that the system is not bound by its form today; it can be modified to meet future criteria simply by updating of the SOS file on the master diskette. For all intents and purposes, SOS is transparent to the user.

All of the higher-level languages available for the Apple /// already are or will be designed to make use of SOS. Only advance machine-language programmers need ever be concerned about the insides of SOS.

Internally there are five modules that combine to make up the "kernel"

of SOS. These modules maintain control over all information flow and are known as the File Manager, the Device Manager, the Memory Manager, the Utility Manager and the Interrupt Manager.

The File Manager, as its name implies, is responsible for the routing and maintenance of files within the Apple /// and its peripherals. Files are sets of information that can represent computer programs, lists of numbers, word-processing documents, mailing lists, accounts receivable or any other set of characters or numbers. The file manager routes these files to wherever the programmer sends them—to a disk device from memory, from memory to the video screen, from a disk drive to a printer, from one section of memory to another, etc.

Peripherals are treated as "device

files" and are referred to from within SOS by name. For example, to list a file on the printer, the programmer simply stores the file in the device file named .PRINTER. SOS tracks the movement and location of files and maintains a highly complex and extremely powerful directory structure. Directories are themselves treated as files.

The purpose of the Device Manager is to manage the flow of information to and from peripheral devices, such as disk drives and printers. In the Apple ///, which is an interrupt-driven computer, the keyboard and video screen are themselves regarded as peripheral devices, and consequently they fall under the jurisdiction of the Device Manager.

SOS can be interfaced to two types of devices: block and character. Block devices handle information in blocks



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Finally, there is the Interrupt Manager, new to Apple programmers, since interrupts are not very well supported on the Apple II. The Apple ///, however, makes full use of the 6502's interrupt capabilities. Interrupts are signals sent to the microprocessor from other devices requesting some service.

As for the SOS Utility Manager, its purpose is to interface with certain built-in hardware facilities, such as real-time clocks and calendars, joysticks and switches. Although relatively minor in nature, when compared with the functions of the other modules, the Utility Manager makes it much easier for a programmer to communicate with the real world.

When the microprocessor receives such a signal from an external device, it immediately stores certain parameters that define its position in the task it is working on. It then drops that task and services the interrupt. In other words, it marks its position for future reference and then performs a prespecified routine triggered by the interrupt signal. After this, it returns to the original task and continues as though nothing had ever happened. The net result of this type of system is greatly increased throughput.

One illustration of the power of interrupts is the way in which the two Apple models differ in their interfaces with the keyboard. With the Apple II, when the programmer tells the computer to read the keyboard, the computer sits in an endless loop, forever bound until a key is pressed. With the Apple ///, however, the programmer writes an interrupt handler routine that causes the computer to stop its current task whenever a key is pressed and store the value of the key in a buffer. The machine then returns to its original task. All of this can take place in a few milliseconds. The result is that the microprocessor need never sit in redundant loops. One possible application of this feature may be a word-processing program that could conceivably save parts of a document on a disk between keystrokes.

The Sophisticated Operating System is not for the faint-hearted or hobbyist. It is one of the most powerful operating systems available today on a personal computer.

Language that saves time

One of the more important functions of operating systems is their support of higher-order languages. In

such a language one instruction may correspond to many machine-language instructions—sometimes a hundred or more. The use of a higher-order language like BASIC, COBOL, FORTH, FORTRAN, PL/1 or Pascal can greatly reduce the time spent in developing programs. The Apple Pascal operating system allows the user to make very, very efficient use of the Pascal language. Much of the overhead—the time wasted in making the transition from machine language to compiler language—is reduced or eliminated by the compatibility between the language and its operating system.

Apple Pascal comes with an excellent, fully indexed manual. A feature that new users will particularly appreciate is the appendixes devoted to the task of starting up the system. Occasional users will appreciate Pascal's use of a standard prompt line to display most of the available command options.

The friendly UNIX

The UNIX system, trademarked by Bell Laboratories, was developed as a friendly system so non-programmer members of the Bell technical staff could have full use of

the Digital Equipment Corp. PDP-11 timesharing systems in the labs. It was designed by Ken Thompson and enhanced later by a small group consisting of Dennis Ritchie and others at Bell.

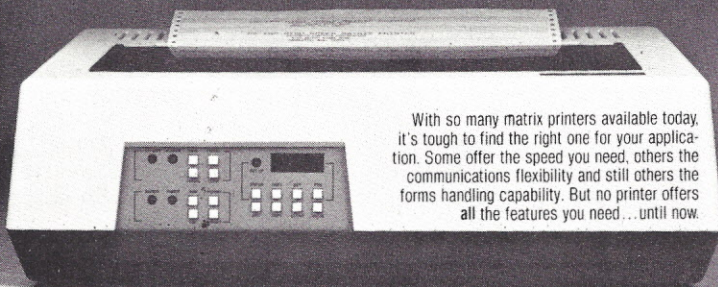
A new user can learn with ease enough of the system to create files, use the Text Editor and connect the output of one program into the input of another through "pipes." The user creates pipes by merely typing a symbol (a vertical bar, if one is available.) The other powerful UNIX tool is the shell.

The shell is a language that serves both for commands and programs and, to provide an interface to the UNIX operating system. It accomplishes input/output redirection—that is, the sending of data either to an output terminal or to a file. It also manages pipelines that connect commands and programs. Another use of the shell is to control flow through such operators as FOR, CASE, APPEND, IF, ELSE and TEST. In addition the shell provides string-valued variables for use in programs.

High-level language support is mainly by the C language, designed

continued on page 108

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Learning Bridge with Computers

For persons interested in learning or playing Contract Bridge, several products are available including both dedicated electronic bridge playing machines and bridge programs that run on personal computer systems such as the Apple II and TRS-80.

Bridge Challenger from Fidelity Electronics and Tryom's new Goren Bridgemaster, similar in many respects, are dedicated electronic bridge playing machines that will bid and play one, two, three or four of the hands of a bridge deal, with human players bidding and playing the remaining hands.

The deals to be played may be entered into each machine by optically scanning actual cards with coded markings or by typing in the cards via the keyboard. The Bridge Challenger also generates deals by the computer. Although the present version of the Bridgemaster does not provide this capability, future versions are expected to.

Each machine has an 8-character, 14-segment, alphanumeric display. Prompting commands, as well as all bids and plays, show on the display. In addition, the Bridge Challenger has a voice output feature which repeats the bids and plays indicated on the display.

Bridgemaster is programmable with different cartridges; that is, as advanced bidding and playing cartridges are developed by Tryom, the modules may be plugged into the same basic unit. Cartridge availability is expected in the second half of 1981.

Products in action

I explored deals on the machines by playing them against one another, playing each deal twice as in a team-

of-four tournament event. Here is the first deal.

North			
♠	832		
♥	32		
♦	AT976		
♣	AKJ		
West		East	
♠	Q97	♠	T
♥	A864	♥	JT75
♦	KJ	♦	Q542
♣	T732	♣	Q985
South			
♠	AKJ654		
♥	KQ9		
♦	83		
♣	64		

I played this deal with Fidelity's Bridge Challenger playing the North-South cards and Tryom's Bridgemaster playing the East-West cards. I later replayed the deal with the Bridgemaster playing North-South and the Bridge Challenger playing East-West.

The bidding, with Bridge Challenger playing the North-South cards and Bridgemaster the East-West cards, went as follows:

West	North	East	South
(BM)	(BC)	(BM)	(BC)
Pass	1D	Pass	1S
Pass	1NT	Pass	4S
Pass	Pass	Pass	

The opening bid of one diamond by Bridge Challenger, and the response of one spade, are straightforward. The choice for North's rebid is difficult with Bridge Challenger selecting one no-trump. South's rebid of four spades is proper.

Bridgemaster, as West, opened the ace of hearts against the four-spade

contract. North played the deuce, East the 5, and South the 9. West continued with the 6 of hearts, North playing the 3, East the ten, and South won with the king. Bridge Challenger, now cashed South's ace and king of trump, for some reason playing the 3 and the 8 from dummy. On the second trump lead, East discarded the 5 of clubs.

Now Bridge Challenger failed to find the correct play. Even though South has only two clubs, a finesse should be taken in the club suit. If the finesse loses, South's diamond loser can be discarded on the second high club honor, and the contract is safe. If the finesse wins, the declarer will make an overtrick. However, Bridge Challenger didn't recognize this situation. After cashing the queen of hearts, South led the 3 of diamonds to North's ace and continued with another diamond.

West won this trick with the king of diamonds, and he later won his queen of trump. Thus, the Fidelity Bridge Challenger, as the declarer, won ten tricks to make the contract. Tryom's Bridgemaster won three tricks for the defense. The complete play of the cards is shown in the tableau below:

Trick	W	N	E	S
no.	(BM)	(BC)	(BM)	(BC)
1	AH	2H	5H	9H
2	6H	3H	TH	KH
3	7S	3S	TS	AS
4	9S	8S	5C	KS
5	4H	6D	7H	QH
6	JD	AD	2D	3D??
7	KD	7D	4D	8D
8	2C	AC	8C	4C
9	8H	TD	QD	4S
10	3C	KC	9C	6C
11	7C	9D	5D	5S
12	QS	2S	JH	6S
13	TC	JC	QC	JS

When Bridgemaster played the North-South cards and Bridge Challenger played the East-West cards, the bidding was as follows:

West (BC)	North (BM)	East (BC)	South (BM)
Pass	1D	Pass	1S
Pass	2S	Pass	4S
Pass	Pass	Pass	

Bridgemaster made the same opening bid of one diamond with the North hand and the same response of one spade with the South hand. However, Bridgemaster chose to rebid two spades with the North hand rather than one no-trump. As before, South's rebid of four spades is proper.

Bridge Challenger, as West, opened the deuce of clubs against the four-spade contract. Bridgemaster played North's king of clubs to win the first trick.

The best play for the declarer at this point is probably to enter the South hand with a high trump and then finesse the jack of clubs for the same reason as explained when the Bridge Challenger was the declarer. However, Bridgemaster also failed to find this play. At trick two it cashed dummy's ace of clubs.

Next, the ace and king of trump were cashed, followed by the lead of the 3 of diamonds from South. West played the jack, and the trick was won with North's ace. Then, the jack of clubs was led from the dummy and ruffed with the 4 of spades. At trick seven Bridgemaster led South's 8 of diamonds, which was won by West's king of diamonds.

Bridge Challenger now made a nice play, cashing West's spade queen, thus preventing a heart ruff in the dummy. At this point the best defense would be to lead a club, which South would ruff, but then South would have to attack the heart

suit, and the defense should win two heart tricks to set the contract one trick. Bridge Challenger elected to play West's ace of hearts, however.

The declarer now has the rest of the tricks. Thus, on the first deal both Bridge Challenger and Bridgemaster bid game in spades, with each program winning ten tricks as declarer and three tricks on defense. The complete play of the cards with Bridgemaster as the declarer was:

Trick no.	W (BC)	N (BM)	E (BC)	S (BM)
1	2C	KC	8C	4C
2	3C	AC??	5C	6C
3	7S	2S	TS	KS
4	9S	3S	2D	AS
5	JD	AD	4D	3D
6	7C	JC	QC	4S
7	KD	6D	5D	8D
8	QS!	8S	7H	5S
9	AH??	2H	5H	9H
10	TC	7D	9C	6S
11	4H	3H	TH	QH
12	6H	9D	JH	KH
13	8H	TD	QD	JS

Let's look at a second deal and see how each machine bid and played the deal. As you will see, Bridge Challenger and Bridgemaster arrive at a different contract.

The deal was as follows:

North	
♠	KQ642
♥	62
♦	K752
♣	T5
West	East
♠	J73
♥	75
♦	Q8
♣	KJ9742
South	
♠	5
♥	AQ43
♦	AJT6
♣	AQ86

As before, I first played this deal with Bridge Challenger playing the North-South cards and Tryom's Bridgemaster playing the East-West cards. I then switched the hands played by the two machines.

The bidding, with Bridge Challenger playing North-South went as follows:

West (BM)	North (BC)	East (BM)	South (BC)
—	Pass	Pass	1D
Pass	1S	2H	3C
Pass	4D	Pass	5D
Pass	Pass	Pass	

Bridge Challenger was playing five-card major suit openings and therefore could not open one heart with the South hand. It opened with one diamond, although one club would have been a better choice.

As North, Bridge Challenger responded one spade, which is fine. As East, Bridgemaster bid two hearts; Bridge Challenger rebid three clubs. A better bid for South would be two no-trump or a double.

West passed, and North has a difficult choice of bids. Bridge Challenger elected to bid four diamonds, and South carried on to game in diamonds. Looking at the North-South cards, you can see that the contract is rather ambitious.

As West, Bridgemaster opened the 7 of hearts against the diamond contract. North played the deuce, East played the king, and South won with the ace. Bridge Challenger apparently decided to finesse West for the queen of diamonds, as it next played South's ace of diamonds, followed by the jack. On the second diamond lead West necessarily played the queen, and North played the diamond king to win the trick.

Next, Bridge Challenger played a third round of trump, leading the 5 of diamonds from North, East following with the 9, and South win-

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ning with the ten. Leading a third round of diamonds was not a good idea, but this hand is a bit too difficult for the computer, as it would be for many human players.

At trick five, Bridge Challenger cashed the queen of hearts and ruffed the 3 of hearts with dummy's last diamond. The 5 of clubs was led from dummy and South's queen finessed. This lost to West's king.

Bridgemaster now made a bad play, leading the 7 of clubs from the West hand at trick eight. The jack of clubs would have been fine, but the lead of the 7 gave away a trick, permitting the ten of clubs in dummy to win the trick.

Now Bridge Challenger found a bad play. With the KQ642 of spades in dummy opposite declarer's singleton 5, Bridge Challenger led the deuce of spades! East played the 9, which won the trick, South following with the 5, and West with the 3.

East played the ace of spades, which was trumped by South's last trump, the 6 of diamonds. The jack or ten of hearts would have been a much better play by Bridgemaster for East.

South's ace of clubs won the next trick, after which Bridge Challenger led South's 8 of clubs. West won with the jack of clubs. Trick 13 was won by dummy's king of spades.

The result, then, on this deal was ten tricks for Bridge Challenger as the declarer and three tricks for Bridgemaster as the defenders. The complete play was:

Trick	W	N	E	S
no.	(BM)	(BC)	(BM)	(BC)
1	7H	2H	KH	AH
2	8D	2D	3D	AD
3	QD	KD	4D	JD
4	2C	5D?	9D	TD
5	5H	6H	8H	QH
6	4C	7D	9H	3H
7	KC	5C	3C	QC
8	7C??	TC	8S	6C
9	3S	2S???	9S	5S
10	7S	4S	AS??	6D
11	9C	6S	TS	AC
12	JC	QS	TH	8C
13	JS	KS	JH	4H

Playing Bridgemaster at North-South, and Bridge Challenger at East-West, the bidding was as follows:

West	North	East	South
(BC)	(BM)	(BC)	(BM)
—	Pass	Pass	1H
Pass	1S	Pass	2D
Pass	Pass	Pass	

Bridgemaster was not playing 5-card major suit openings and therefore opened the South hand with one heart. As North, Bridgemaster responded one spade, which is fine. Now as South, Bridgemaster rebid two diamonds. With this mention of a new suit by the opener, North should bid again rather than passing. North should bid two spades or three diamonds. The final contract, however, was two diamonds.

As West, Bridge Challenger opened the 7 of clubs against the diamond contract. As you can see, this was a friendly lead into declarer's AQ. Bridgemaster played the 5 from dummy, East played the 3, and South won with the 8 of spades. At trick two, Bridgemaster tried to cash the ace of clubs. However, this was ruffed by East with the 3 of diamonds.

East returned the 9 of hearts, and Bridgemaster properly finessed South's ace of diamonds and then led another diamond to North's king, which picked up both outstanding trump.

Next came a heart to the ace, followed by a heart ruff in dummy with the 5 of diamonds. Now Bridgemaster played the spade queen from dummy, and Bridge Challenger did not win with the ace but played the 8 of spades! This simply gave away a trick.

At trick nine, Bridgemaster led dummy's king of spades. This time Bridge Challenger played the ace but was too late. South ruffed with the ten of diamonds. Then, a club was ruffed in dummy with dummy's last trump, and a spade ruffed with declarer's last trump.

The last two tricks were won by

continued on page 92

continued from page 66

In running the program, you are prompted for the number of lines you wish to display (a maximum of 15 is provided, but you can change this to as many as 22 simply by changing the “CONST MAXLINES = 15” to “MAXLINES = 22” for example). After you have entered the desired number of lines, the cursor will appear at the upper left corner of the screen and pause for you to enter your character strings, a line at a time, up to the maximum number you have specified. At this stage a prompt will appear, “ARRAY FORMED: RETURN.” At this point, hit the return key and—

presto!—the strings are converted line for line to mixed upper and lower case.

But, you may ask, how does one switch from upper-case to lower? Is the shift key used? The answer is that whenever you wish a capital letter to be displayed or printed, simply precede the letter by typing the “@” character—that is, the shift key and the letter “P” (SHIFT-P). The rest is a piece of cake.

Try this program on your own computer, if you have Pascal. You're going to be hooked on mixed characters; they make your programs look 100 % better and the price is right. □

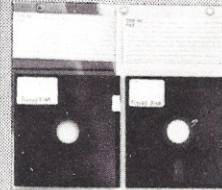
The upper and lower case you see here is typical of that produced by a number of accessory terminals now available for your microcomputer. Compare the appearance of these characters, produced by the "Apple Writer" text editing program and a Silentype printer, to those displayed by GRFPRT. "Apple Writer" transforms upper case letters entered at the console into mixed U/L case when sent to the printer.

```
"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN  
OPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~  
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH  
IJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu  
vwxyz{|}~!"#$%&'()*+,-./0123456789:;<=>  
?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefg  
hijklmnopqrstuvwxyz{|}~!"#$%&'()*+,-./0123456  
789:;<=>?@ABCDEFGHIJKLMNOPQRS TUVWXYZ[\]^_  
`abcdefghijklmnopqrstuvwxyz{|}~!"#$%&'()*+,-.  
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQRS TU  
VWXYZ[\]^_`abcdefghijklmnopqrstuvwxy z{|}~!  
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEF  
GHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq  
rstuvwxyz{|}~!"#$%&'()*+,-./0123456789:  
;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`ab  
cdefghijklmnopqrstuvwxyz{|}~!"#$%&'()*+,-.  
/0123456789:;<=>?@ABCDEFGHIJKLMNO PQRSTU  
VWXYZ[\]^_`abcdefghijklmnopqrstu vwxyz{|}~!
```

This is an example of mixed U/L case characters that you can send to CRT or Silentype printer using the GRFPRINT program. Notice the true descenders you get and the clean look. What's more—the "price is right."

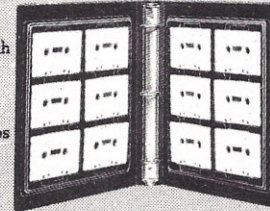
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CIRCLE 52

continued from page 90

The last two tricks were won by West with the king and jack of clubs.

The final result of the game was the same as before, although Bridge Challenger and Bridgemaster played differently. Bridgemaster won ten tricks as declarer; Bridge Challenger took three tricks on defense.

The complete play of the cards was:

Trick	W	N	E	S
no.	(BC)	(BM)	(BC)	(BM)
1	7C	5C	3C	8C
2	2C	TC	3D	AC
3	7H	2H	9H	QH
4	8D	2D	4D	AD
5	QD	KD	9D	6D
6	5H	6H	8H	AH
7	3S	5D	TH	3H
8	7D	QS	8S ???	5S
9	JS	KS	AS	TD
10	9C	7D	9S	6C
11	4C	6S	TS	JD
12	KC	2S	JH	QC
13	JC	4S	KH	4H

From the two deals discussed, you can see that both Bridge Challenger and Bridgemaster play fair games of bridge. Occasionally, each machine makes a very bad play, but then so do human bridge players!

In addition to dedicated bridge playing machines, a number of software packages that are now available for popular personal computers help beginners sharpen their skills.

Bridge playing programs

CompuBridge, written for the Apple II computer and distributed by Barclay Bridge Supplies of Port Chester, New York, is a series of programmed lessons on contract bridge. Six chapters teach a standard American system of bidding oriented to five card major openings. The chapters cover material from an introduction for the absolute beginner to defensive play and competitive bidding.

In addition to one program for each chapter, there is a "Quizmaker" program and a "Play of the Cards" program.

Quizmaker deals random hands for problems on point count, opening bids, and responses and rebids. You are asked for your answer to each problem. If your answer is not correct according to CompuBridge, you may try

alternative answers or you may ask for the CompuBridge proposed answer. The Play of the Cards program deals with high card tricks, tricks by finessing, tricks by double finessing, and long suit tricks.

The first two chapters in the package presents information for persons learning bridge for the first time; the remaining four chapters cover frequently occurring bidding situations. Each chapter provides from one to eleven "screenfulls" of information on a particular topic. You are then presented pre-selected hands and are asked for your bid in the given situation. If your choice of bid is correct, you are given the reason; if your choice of bid is incorrect, you are shown the correct bid, and, as before, you are given the reason for the correct bid.

With some of the bidding subjects you may ask the Quizmaker program to generate random deals for you to further practice your understanding of the current bidding subject. The ability to explore bidding subjects through the generation of random hands by the Quizmaker program, is an attractive feature of CompuBridge because you can compare your bidding ideas with those of CompuBridge for a large number of hands.

For Chapter 3, opening bids, a deal of 52 cards is generated for each set of four problems, with each hand in turn being shown for an opening bid.

I also explored Quizmaker's performance on Chapter 4's responses and rebids. For each random hand, you are asked (as five separate problems) what you would bid over an opening bid by partner of 1 club, 1 diamond, 1 heart, 1 spade, and 1 no-trump.

CompuBridge properly suggested a 1 spade response to partner's 1 club or 1 diamond opening bid. However, over partner's opening 1 heart bid, CompuBridge recommended a "Pass", whereas a 1 spade response is just as proper as over 1 club or 1 diamond. The 2 spade raise to 1 spade is fine, as is the Stayman bid of 2 clubs over 1 no-trump.

All in all, CompuBridge is a worthwhile product for the average home bridge player who wishes to sharpen bidding skills. The few problems observed will likely be corrected by the time you read this.

No-Trump Bridge, written for the TRS-80, Model 1, Level II computer and distributed by Instant Software of Peterborough, NH, is designed for playing no-trump contracts. The computer program generates random deals, discarding those it considers unsuitable for you to play at a no-trump contract. For each deal the program considers suitable for no-trump play, it decides on a contract and asks if you wish to play the deal.

On the deals you elect to play, you are South, the declarer, at the computer determined contract. You play the North and South cards, while the computer program defends with the East and West cards.

Here is the first deal the program accepted when I ran it for the first time. Your cards and those of the dummy are as follows:

continued on page 94

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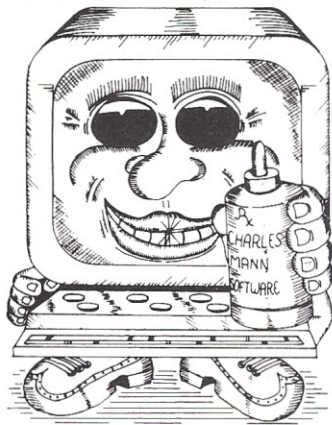
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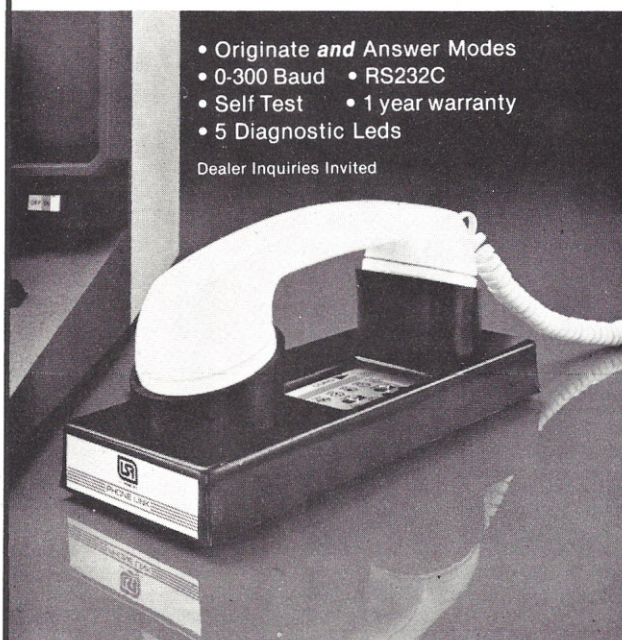
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CIRCLE 56

North
(Dummy)
♠ AK7
♥ T42
♦ QJT63
♣ 42

South
(Declarer)
♠ J954
♥ QJ975
♦ A5
♣ AT

The computer program suggested a contract of two no-trump. Looking at the N-S cards, a contract of two or three hearts is a much better contract, but the program retained this deal for play in no-trump.

As West, the computer opened the queen of clubs against the two no-trump contract. I played small from dummy, East played the 3, and I played the ten from my hand. West continued with the jack of clubs, on which East played the 6, and I won with my ace.

The chances of making this hand did not appear very bright. I entered dummy with the king of spades and led the queen of diamonds from dummy. East played the deuce, a good play as it will be seen, and I played the ace. I could not afford to have West win with the king and then, after the cashing of club tricks by the defense, have the defense play spades while the diamond suit was blocked. I played the 5 of diamonds from my hand, West followed, I played the ten from dummy, and East won with the king.

At trick 6, East played the 9 of clubs, on which West played the 8, while I discarded a small heart from each hand. East continued with the 5 of clubs, which West won with the king, while I again discarded a small heart from each hand. It was a surprise to see West show up with the king of clubs. This meant that the computer program had made the unusual opening lead of the queen of clubs from a suit of four or five clubs headed by the king-queen-jack.

West now cashed the 7 of clubs, I discarded the ten of hearts from the dummy, East discarded the 6 of spades, and I discarded the 5 of spades from the South hand. The defense now went wrong. West led the ten of spades, instead of cashing the ace of hearts to set the contract. I didn't think the computer program would have unguarded the queen of spades in the East hand, which meant that my only chance to make the 2 no-trump contract was to play low from the dummy, hoping that West had led away from the queen of spades. This was the case; on the 7 from dummy East played the 3, and I won the trick with the jack of spades.

I won the last four tricks with dummy's ace of spades and three good diamonds, thus making the 2 no-trump contract. As you can see from the complete deal shown below, I should have lost four club tricks, one diamond trick, and two heart tricks, for down two tricks. However, the defense never found their two heart tricks.

One comment about No-Trump Bridge is that you cannot regenerate a given deal. It would be informative to know how the program responds to different lines of play by the declarer on the same deal, besides giving you a chance to see the results of different lines of play. □

Are computers hazardous?

continued from page 35

2,000 to 3,000 millirems per year on the job for 10 years. Other studies have shown higher levels of damage in workers exposed to low-level radiation than would have been extrapolated from knowledge of the effects of high-level radiation. Still other experts disagree and feel low-level radiation may be even less hazardous than has been previously assumed.

One thing seems clear. There is no evidence now of a threshold level below which radiation has absolutely no effect. Those effects may be very, very slight at low levels, but my survey of the information available to the non-scientist doesn't convince me that we can totally dismiss these effects.

So, to return to the question of possible dangers in the classroom, there is no hard evidence now of a need for any changes in the way computers are used. Certainly it wouldn't be a bad idea for children to sit as far away from the monitor as practical. In addition manufacturers should be encouraged to produce monitors with low voltage. Buying the safest possible monitors should always be a top priority. But it's when we start seeing children using computers for longer hours in school and contemplate their going into the workplace and spending more years in front of a screen on the job that we will need to look very carefully at safety questions. By then more information should be available to help resolve the questions.

Vision problems bear watching

The second area of concern, vision-related problems caused by or aggravated by reading from video screens, is more immediate. People who use video screens for hours at a time complain of eyestrain, headaches and blurred vision.

Some unions are now demanding frequent rest breaks and regular eye examinations to counter vision problems. They're also asking for changes in the workplace to reduce glare. Indirect lighting and shading of windows make the screen easier to read.

But, again, there are no definitive answers. Every study showing increased eye problems has its critics. Permanent eye damage may not be a problem, but headaches and tired eyes are real and should be avoided. For schools and homes, these problems may prompt changes in the way computers are used.

First, thought should be given to place the computers in spots where visibility is at a maximum. Second, school administrators should keep in mind the need for rest breaks—perhaps 10 minutes an hour if students are working for long periods at computers or word-processing systems. Third, schools should try to buy screens with sharp images to reduce the difficulty of reading. This may mean picking a computer of higher resolution or buying a monitor—as opposed to a TV set—because the monitor signal is less degraded and the image is clearer. Safety and comfort should play a role in purchases. ☐

How do you beat a chess computer?

**By reading...
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YOUR CHESS
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Kaplan, an international chess master and a former World Junior Champion, is by profession a computer programmer and one of America's most popular chess teachers and columnists. In simple, logical, understandable steps, he shows you how a chess computer "thinks" and why constructing a chess program is so difficult. For example, because a computer cannot reason, it must examine every possible move. But no machine can be expected to analyze the consequences of every possibility to infinity; a limit must be set. This "horizon effect" is responsible for the computer's great weakness in playing chess—its inability to plan. Kaplan lucidly explains the various ways that programmers deal with this problem.

The author gives you specific positions to practice against the machine and shows you how to benefit not only from its tactical accuracy but also from its strategic weakness. And because the computer's play will always be consistent, you'll easily be able to measure your own progress, whether you're just learning the game or are an advanced tournament player.

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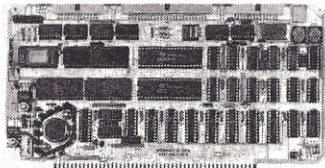
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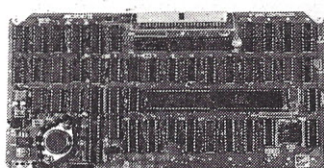
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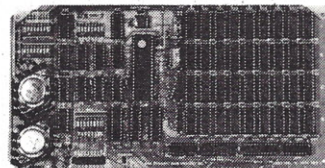
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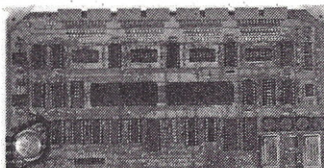
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MODEL X5 — Desktop Mainframe — 5 Cards — Small Power Supply \$200
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MODEL 7000 — Horizontal Desktop Disk/Cover — 2 Eight Inch Drives — Drives Horizontal \$250
Cabinet size: 17" w x 23" d x 7.5" h. Cabinet painted dove grey, front panel is black. Mounting for 2 eight-inch Shugart SAB01R Floppy Disk Drives (or mechanical equivalent). Drive mounting brackets supplied. Drives not supplied. 70CFM fan, 6" three-wire line cord, power switch, line fuse, EMI filter and clamped flat cable exit on rear panel. P794 power supply: +5@4A, +24@5A—6A peak, -5@.75A. All voltages regulated. Power supply is a removable module.

MODEL 8000 — Desktop Main/Frame — 15 Cards — Standard Power Supply \$255
Cabinet size: 17" w x 20.5" d x 7.5" h. Cabinet painted dove grey, front panel is black (other color schemes optional). 15-position IEEE compatible motherboard (will accept 1801 terminator kit, optional), card cage with all guides. Reset switch on front panel. Power switch, 8 DB25 cutouts, 2 BNC mounting holes, 70CFM fan, EMI filter, 6" power cord, line fuse, and clamped flat cable exit on rear panel. P800 power supply (+8@15A, +16@3A, -16@3A). Power supply is a removable module. Motherboard connectors optional.

MODEL 7000S — Vertical Desktop Disk/Cover — 2 Eight Inch Drives — Drives Vertical \$250
Cabinet size: 13.5" w x 23" d x 11" h. Cabinet painted dove grey, front panel is black. Mounting for 2 eight-inch Shugart SAB01R Floppy Disk Drives (or mechanical equivalent). Drive mounting brackets supplied. Drives not supplied. 70CFM fan, 6" three-wire line cord, power switch, line fuse, EMI filter and clamped flat cable exit on rear panel. P794 power supply: +5@4A, +24@5A—6A peak, -5@.75A. All voltages regulated. Power supply is a removable module.

continued from page 21

serial printer, capable of operating at 300 baud or more, which can be connected to a jack on the rear panel of the modem. This provision eliminates the need for expensive printer interface devices.

Data communications can be transcribed with the Microconnection. Connections are provided to permit interfacing to a low cost cassette recorder. Several hundred thousand bytes can be stored on a standard C60 cassette. This data can be played back into the modem after the connection to the host computer is terminated.

The Microconnection for the TRS-80 Color Computer is priced at \$199.50. For additional information contact the Micro-peripheral Corporation, 2643 151st Place N.E., Redmond, WA 98052; (206) 881-7544. *Circle No. 106*

Self-Answer Modem



A direct connect modem, capable of full duplex operation at 300 bits per second, and providing automatic answer service has been added to Universal Data Systems' LP series of telephone line-powered units. Designated the UDS 103J LP, the new product is priced at \$245 each.

A manual switch on the 103J LP backpanel selects either originate or answer frequency pairs. Regardless of how the switch is set, the modem will automatically answer incoming data calls in the answer mode when the front panel selector is set to data.

The UDS 103J LP has a carrier

detect sensitivity of -46dBm and an automatic loss-of-carrier disconnect of 12 seconds. Carrier detect delay is 150 mS ON and 50 mS OFF, with a clear-to-send period of 300 mS plus carrier detect period.

Housed in a plastic cabinet designed to fit directly beneath an ordinary desk telephone set, the UDS 103J LP has a profile only slightly more than one inch high. Connections are via RJ-11 type snap-in modular plugs. The unit has an RS-232C (CCITT V.24) digital interface.

A front panel selector allows the user to choose between ordinary voice conversations and data communications. When the selector is set to data and the telephone circuit is in an off-hook condition, a red LED lights up.

For more information contact Universal Data Systems, 5000 Bradford Dr., Huntsville, AL 35805; (205) 837-8100.

Circle No. 107

INTERFACES

Interface Converter

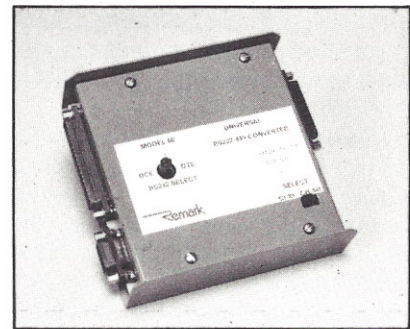
Remark International has introduced the Model 60, an interface converter to allow coupling of RS-232C based equipment with devices employing the new industry standard RS-449.

The interface requirements are different depending on whether the RS-232C devices are considered DTE (Data Terminal Equipment) or DCE (Data Communications Equipment). The Model 60, Universal RS-232/RS-449 Converter, incorporates the switching facility to allow you to select the RS-232 as a DCE or DTE. Support of reverse channel for the RS-449 is provided by the required separate 9-pin male connector. The RS-232 port has a 25-pin female connector while the RS-449 port has a 37-pin male connector.

The Model 60 incorporates the necessary resistive pad termina-

tions to protect the RS-422/423 receivers from the large voltage swings of RS-232 drivers. These resistor pads are switched, as necessary, for RS-232 DTE's or DCE's. You are offered the ability of strapping the shield of RS-449 to Frame Ground or Signal Ground of RS-232.

Another variable in adapting RS-232 to RS-449 is the interconnection of CH (Data Signal Rate Selector—DTE source) with SR (Signaling Rate Selector) or CI (Data Signal Rate Selector—DCE source) with SI (Signal Rate Indicator). The Model 60 provides a separate front panel accessible switch that allows user selection of CH/SR or CI/SI.



The Model 60 is compatible with the new Dataphone II Modems from Western Electric and other modems from various manufacturers and is in full compliance with the EIA Industrial Electronics Bulletin No. 12, "Application Notes on Interconnection Between Interface Circuits Using RS-449 and RS-232-C."

Model 60 has a label on the bottom cover which lists all of the signals by name, pin number and signal direction. A listing of the conventional RS-232 is included as a reference.

The product is packaged in an aluminum enclosure whose dimensions are 5" W, 6" D, 1.5" H. Prices start at \$115. For more information contact Remark International, 4 Sycamore Dr., Woodbury, New York 11797; (516) 367-3806.

Circle No. 108

NEW LITERATURE

Three New Books

OSBORNE/McGraw-Hill announces the release of three new titles in time for the 1981 NCC show. The first is *The Apple II User's Guide* by Lon Poole, Martin McNiff, and Steven Cook and is a guide to the Apple II and Apple II Plus Computers. It covers Applesoft and Integer BASIC programming—especially how to make the best use of Apple's sound, color, and graphics. Separate chapters describe the disk drive and printer in detail. The guide also contains special sections on advanced programming, high resolution graphics techniques, and the machine language monitor. The price is \$15.

The second book to be announced is *The Business System Buyer's Guide* by Adam Osborne and it unravels the task of buying the right microcomputer system for a small business. Dr. Osborne provides information on how to determine your needs, how to choose software and hardware for all business applications, what to expect from vendors, what to avoid, and what questions you must ask. He also provides detailed information on products, manufacturers, retailers and the whole microcomputer marketplace. This book costs \$7.95.

The last book is called *6809 Assembly Language Programming* and it is written by Lance Leventhal. This book is the latest in Osborne's Assembly Language Programming series which already covers the 6502, Z80, Z8000, 8080A/8085, and 6800 microprocessors. As in all the Osborne books, *6809 Assembly Language Programming* contains numerous reference tables, explanations, descriptions, the entire instruction set, and many practical fully debugged program examples.

The price of this book is \$16.99.

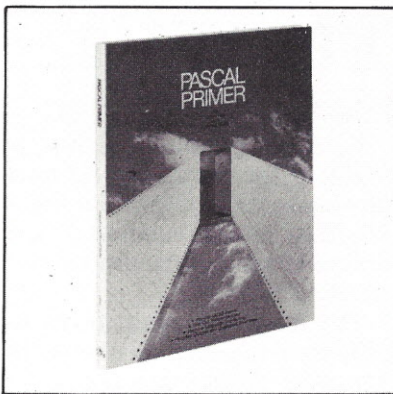
For more information contact OSBORNE/McGraw-Hill, 630 Bancroft Way, Berkeley, CA 94710; (415) 548-2805.

Circle No. 109

Pascal Primer

Pascal Primer, just released by Sams, is a book written for the novices, hobbyists and computerists who are eager to travel into the fascinating world of Pascal.

Instead of cramming all of the obscure features of Pascal into the book, the authors Mitch Waite and David Fox elected to keep it as a primer—a book which introduces the language. But even so, the book includes all of the major concepts and tools of Pascal in enough detail to permit the reader to write powerful programs in the language.



The concepts of Pascal are presented gradually. Each piece of information builds on the previous lessons. The early material contains no hidden assumptions that the reader knows anything about programming. Quizzes are included throughout the book to permit the reader to test his or her understanding of the material.

The most widely used version of Pascal is the UCSD™ version. This version was used as a guide in writing *Pascal Primer*.

Eight appendices in the book

present facts about the advantages and disadvantages of Pascal, components of a Pascal system, interfacing assembly language routines and other useful information. The essentials of Pascal are also included on the handy tear-out reference card. This 208 page wirebound book costs \$16.95. For more information contact Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, IN 46268; (317) 298-5400. Circle No. 110

Computer Advice

Even today computers present a futuristic aura that makes many business people hesitate about delving into the subject. A new book, published recently by dilithium Press, has been designed to strip away this mystique with informal, no-nonsense coverage of the matter.

Known as *Small Computers for the Small Businessman*, this 200 page paperback, which sells for \$12.95, was written by business consultants rather than programmers.

In the book the authors answer several questions that often come up, including: "How and where to shop for a computer successfully? What they can expect their computer to do for them? How much computer is necessary?" and "How to select software?" Also included is a glossary of computer terms.

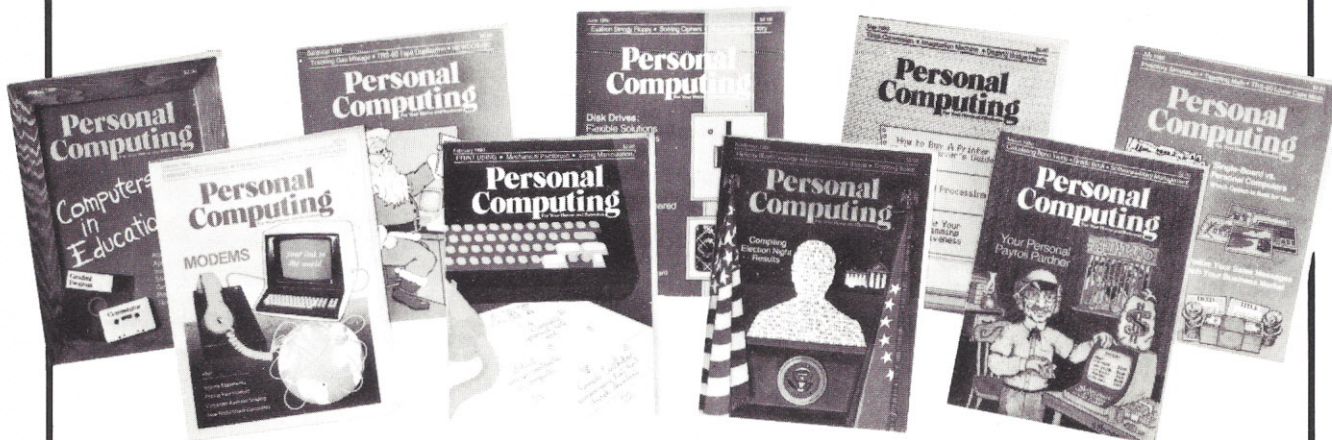
For those businesspersons who have considered a computer for their business but didn't know where to turn, this is the book that will arm them with the information needed to make an intelligent, cost-effective decision.

For more information contact dilithium Press, 11000 S.W. 11th St., Beaverton, OR 97005; (503) 646-2713. Circle No. 111

continued on page 103

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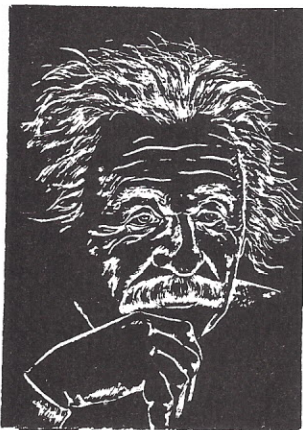
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An Intelligent Alternative

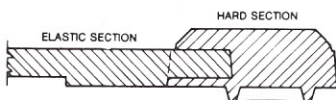


In the research you are doing before purchasing your computer printer, you are probably confused by the various claims, speeds, choices, shapes and prices. Well, we'd like to clear the air a bit and tell you about the most unusual computer-printer around — the TYPRINTER 221.

You see, it's unusual because it is **totally compatible** with every computer and word processing program... from the largest to the smallest. It's versatile to the point of incredibility... We'll discuss the broad advantages and explain the details.

THE DAISY WHEEL

The special daisy wheel supplied is of a unique design consisting of a 100 character carrying radii. Each radii is formed of two distinct types of plastic — an "elastic plastic" for the stalk of the radii, and a comparatively "hard plastic" used to form the character area. This, combined with a very narrow character profile and a special positioner on each of the 100 radii, guarantees a uniform character density. There is near perfect geometric positioning of the character with no character higher or lower than the others. And because of its unique dual material design, micro-vibrations have virtually been eliminated, leaving your final copy clean, clear and smudge free. The copy produced is comparable to that produced by metal daisy wheels and at a fraction of the cost.



THE KEYBOARD

The keyboard has been referred to as a triumph of human engineering - from the way the keys seem to have been custom designed to fit your fingers, to the way the special feature switches have been grouped. A flip of a switch (or under computer control of course) and the printer becomes a foreign language machine. Push a button, and like magic the printer automatically locates and lines up columns of figures, perfectly balanced between the margins. This incredibly fast, extraordinarily quiet electronic keyboard puts more programming power at your fingertips than printers costing five to ten times as much.



TYPRINTER 221

THE DISPLAY

The TYPRINTER 221 presents a new dimension in operator/machine communications. In the manual (typewriter) mode, the printer controls and verifies all entries before printing. The display exhibits the last 15 characters of the text, word-by-word, until the end of the line. The operator may control what will be printed before the actual printing takes place. This new found flexibility enables you to make modifications along the entire line and in both directions. This 20 character plasma display has the ability to scroll backwards as well as forwards; will give the operator a visual indication as to which print mode is currently being selected as well as the number of characters remaining before the right margin is reached. The display will also indicate to the operator:

The number of characters available in the memory.	What characters will be inserted into an existing text.
When the printer is in an error condition.	When the memory for the previous line has been selected.
When a pre programmed form lay out has been selected.	A warning message that the end of the page is being approached.
When the printer is operating from the internal memory.	That a hyphenation decision must be made.

PRINT MODE

The TYPRINTER 221 will allow you to automatically highlight individual characters, words or complete sentences. Whatever is entered from the keyboard or from the computer, even an existing text file, can be printed in one or more of the five different modes:

- traditional printing;
- underlined characters;
- true bold characters where the horizontal component of the character is increased without disturbing the vertical component;
- characters which are both bold and underlined, and;
- a feature unique among computer printers - printing in reverse — white on black, sort of reverse video on paper.

MULTILINGUAL CAPABILITY

A unique and useful feature of the TYPRINTER 221 is its capability of being able to print in several languages without changing the daisy wheel. In addition to English, every standard daisy wheel has the ability and the necessary characters to print in French, Spanish, Italian and German.

THE FEATURES

Automatic justification of the right margin

The electronics of the TYPRINTER 221 have made right hand justification a simple, automatic operation.

Phrase and format storage

Phrases, dates, addresses, data, etc. that may be stored in your computer's memory may be sent over to the printer and stored in one of the "memory bins" of the printer. This information may then be used by the operator in the manual mode. This can save you hours when trying to get a form "just right."

Automatic centering

The TYPRINTER 221 will not only center any title between the pre-set margins, but will also center over one or more columns, or over any specific point and will even align copy with the right margin independent of the left margin.

Automatic vertical lines

A command from the computer enables an automatic feature which prints vertical lines at any point on the paper.

Automatic tab sequence recall

With the TYPRINTER 221 you may store and recall the most frequently needed margin and tab sequences for applications such as daily correspondence, statistical reports, etc. This guarantees consistent high quality appearance of each document.

Paragraph indent

A computer command instantly sets a temporary margin in order to print one or more indented paragraphs with respect to the right margin.

Automatic decimal point location

No matter how many figures to either the left or right of the decimal point, the TYPRINTER 221 will automatically line up the figures with the decimal point in any position you choose. Statistical printing has never been easier.

Column layout

This feature allows you to obtain automatic and perfect distribution of spaces between columns in respect to the margins. A perfect page balance is assured without the need to carry out calculations or additional operations.

There is a wide variety of options that you can add to TYPRINTER 221.

By now you are probably convinced that we are sold on our machine, and we hope you can understand why. In fact, why don't you use these facts to measure against any and/or all the other computer printers on the market.

When you do, you will realize the TYPRINTER 221 is an intelligent electronic typewriter, a text formatter — and a brilliant computer printer — available at a suggested list price of only \$2850.

TYPRINTER 221 is available at your local computer shop — or we'll tell you where you can see and try one if you call us at

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BUSINESS

Financial Planning

Westico announces the availability of a new microcomputer program for financial planning—MINIMODEL. The program runs on such computers as the TRS-80 Model II, Cromenco, North Star, and others which use a CP/M-like operating system.

MINIMODEL is for answering those "what if?" questions raised in cash flow projections, financial forecasting, venture analysis, long range planning, project planning, risk analysis, and more. This new software can be run on microcomputers that cost one tenth as much as dedicated financial planning computer systems.

Features include a model size limited only by disk space, model time horizon that can be advanced to eliminate old data, models that can be consolidated into a higher level model, and consolidated models that can be processed under their own set of rules. Model details may be printed or displayed, and output report content and formats are flexible under user control.

MINIMODEL is priced at \$495. Documentation alone is \$50. For more information contact Westico, Inc., 25 Van Zant St., Norwalk, CT 06855; (203) 853-6880.

Circle No. 112

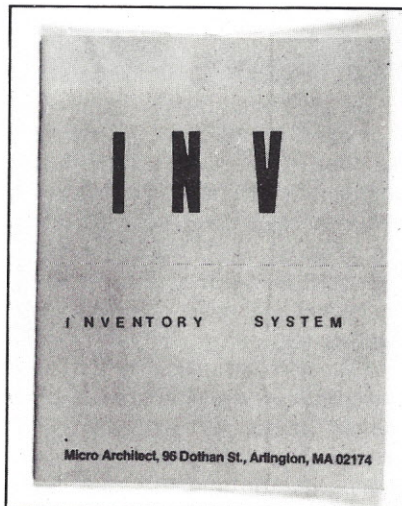
Inventory System

'INV' is an inventory control system for 32K TRS-80 systems. Over 2000 items can be maintained on a system disk; more if you have more than one disk drive. The system consists of initialization, data base manager, and report generator modules.

This package provides control functions to allow you to maintain

an efficient inventory system with improved service at low investment costs by providing efficient order strategy, and tools to measure performance. It is on-line, interactive, menu-driven and human engineered.

"Order Report" gives you all the inventory items at or below the safety levels and the associated order information, such as the order quantity, vendor code, and the total amount in dollars. The system also indicates priority to order. For example, order out-of-stock items first, then the high-profit items, and then the high-usage items.



"Performance Report" provides tools to measure the efficiency of your inventory system and its associated costs. A summary of your system will include total inventory cost, total number of out-of-stock items, over-stock items, etc. Other reports include "Data Base Lister" and "End-of-Year Processor", which also calculates economical order quantity and compares it to the current order quantity.

In addition, the system provides a report writer to allow you to specify unlimited report formats

on-line without programming.

An alphanumeric key is used for fast keyed, random access. Each record has the following fields: key, description, order amount, stock level, annual usage, quantity-on-order, unit cost price, unit sell price, location code and vendor code.

As opposed to other inventory systems that offer key random access, this system lets you delete an inventory record. Other features include screen input, live keyboard, audit log, on-line specification of page sizes. Order processor and usage processor calculates amounts, sales taxes and shipping charges. Report writer includes field arithmetics, selection criteria, multi-key sort, automatic page numbering, and simulated form feed.

INV-M3, available for TRS-80 Model III using the TRSDOS operating system, is priced at \$89. For more information contact Micro Architect, Inc., 95 Dothan St., Arlington, MA 02174; (617) 643-4713. *Circle No. 113*

Text Processor

Charles Mann & Associates, Micro Software Division, has announced a new professional capabilities word processing system for the Apple II or Apple II Plus computers. The Docuwriter Text Processor features its own document writer, universal editor, custom printing element, mailing list, automatic text linker, draft writer, and form letter element.

The system is specifically designed to process long documents and prepare business correspondence. The system allows you to create "link pathways" to use in preparing documents normally too long for system memory. Such documents as contracts and reports can be prepared from standard sec-

tions and linked together into the final document. The system also allows the mailing list and letter files to be linked into form letters. Form letters can be customized to allow the insertion of receiver specific key words and phrases.

The system includes such editing features as global search, global replace, width reformatting, line editing, character insertion, character deletion, line deletion and line insertion. The system also allows block text movements to the disk and back at defined locations. Letters and reports can be "built" from stock sentences or paragraphs, merged together to form paragraphs, linked together to form chapters and finally linked together into total documents.

Docuwriter Text Processor supports most popular letter and correspondence quality printers including such features as superscripts, subscripts, footnotes, scientific notation and full justification. The system offers many page numbering schemes, "copy" designation, form feed or single sheet operation, automatic top of page start for new chapters and continuous disk to printer block streaming.

The Docuwriter Text Processor is available on disk for an introductory price of \$149.95 from more than 650 CMA dealers worldwide. The documentation manual is available separately for \$20. Additional information is available from Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284; (714) 365-9718.

Circle No. 114

EDUCATIONAL

Basic Living Skills

A new breakthrough series of microcomputer educational (MCE) programs designed for special needs audiences is now available for immediate delivery from Interpretive Education, Inc. This first in

a planned series of MCE programs geared to practical day-to-day living situations include: Poison Proof Your Home, Income Meets Expenses, You Can Bank On It, Home Safe Home, Money Management Assessment Series and Job Readiness Assessment and Development.

The MCE programs are currently available for application on the Apple II Applesoft 48K with disk drive. The programs contain from four to eight diskettes and range in price from \$165 to \$340 per program.



The MCE programs are unique in that they interface established teaching principles with the latest computer technology to achieve a new level of educational excellence, the company said. MCE programs automatically individualize content by branching to the learner's own reading and comprehension levels.

All MCE programs are cooperatively developed by a combined team of professional educators and micromputer specialists, the company said. Each program is analyzed and evaluated at every stage of development to guarantee program quality and educational effectiveness.

MCE programs contain full supportive and supplementary materials for use by the instructor. The MCE programs are designed to complement the teacher and the total educational process. The catalog and additional information is available from Interpretive Education, Inc., by calling collect (616) 345-8681 or writing Dept. NR2, 2306 Winters Dr., Kalamazoo, MI, 49022.

Circle No. 115

Teaching Spelling

Spelling is a three part, interactive, error-trapped program suitable for use by educators, in a classroom environment, or for home/personal use. It requires a 16K Level II TRS-80 with cassette player and a Radio Shack voice synthesizer. The disk version requires 16K Level II and a minimum of two disks and a voice synthesizer.

The program allows spelling lessons and tests to be given in true spelling bee fashion: verbally. The program is broken into three parts. The first part allows you to develop the proper ASCII spelling of words to cause them to correct sound as pronounced by the synthesizer. The second allows you to create tape or disk files of lessons using any words desired and the third part is the actual spelling program.

The spelling program can funnel an unlimited number of words through itself without regard to users RAM, the company said. Spelling lessons containing foreign languages may also be constructed.

The program is written entirely in BASIC for ease of modification or customizing. Error trapping is used throughout to ensure continuous operation even with erroneous operator responses. Prices are \$19.95, cassette; \$29.95, disk. For more information contact D & M Software, 1510 S. 97th St., Tacoma, WA 98444; (206) 537-8155. *Circle No. 116*

UTILITY

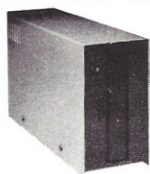
File Sort

Sorting a variety of file types, a new File Sort option is available with the OASIS operating system software for Z80 based systems.

Performing intelligent sorting, field extraction and sequencing of alphanumeric strings, the new OASIS File Sort option supports direct, sequential and ISAM file access methods. Up to 255 keys can be specified to determine sort se-

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CCI-100 TEAC	5 1/4", 40 Track (102K)		\$314
CCI-100 MPI	5 1/4", 40 Track (102K)		\$319
CCI-280	5 1/4", 80 Track (204K)		\$429

ADD-ON DRIVES FOR ZENITH Z-89

CCI-189	5 1/4", 40 Track (102K)	\$394
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External card edge and power supply included. 90 day warranty/one year on power supply.

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ZENITH	Z-19	\$ 735
TELEVIDEO	920C	\$ 748
IBM	3101 Display Terminal	950 \$1049
ATARI	400	\$ 479
MATTEL	INTELLIVISION	800 \$ 795
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MONITORS

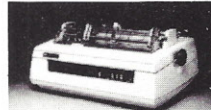
APF	9" B & W TVM-10	\$120
BELL & HOWELL		\$220
LEEDEX	9" B & W BHD911	\$129
SANYO	9" B & W VM4509	\$155
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UNIVERSAL DATA SYSTEMS UDS-103		\$179
D-CAT HARD WIRED DIRECT MODEM		\$189
AUTO-CAT Auto Answer, Direct Connect Modem		\$229
D.C. HAYES MICRO-MODEM		\$329

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IDS 460	Graphics & 2k buffer	\$1050
IDS 560	Graphics	\$1450
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OKIDATA	DP-9500/01	\$1345

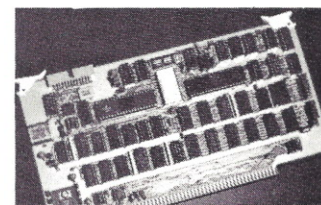
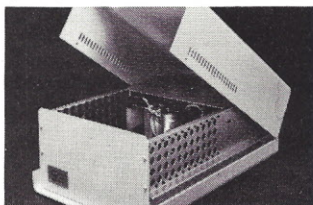
Microline 80	Friction & pin feed	\$ 420
Microline 80	Friction, and pin & tractor feed	\$ 520
Microline 82	Friction & pin feed feed	\$ 620
Microline 83	120 cps, uses up to 15" paper	\$ 849
CENTRONICS 730		\$ 595
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TRS-80* software, compressed print & vert. form control **\$1865**

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200 ns for TRS-80*, Apple II, (specify):	2 for \$56	\$30
	Jumpers	\$2.50

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MAINFRAME	Model 2200A	\$349
Z80 CPU	Model 2810	\$269
MOTHER BOARD	Model 2501	\$106
16K STATIC RAM, 200ns	Model 2116C	\$309
32K STATIC RAM, 200ns	Model 2032C	\$619
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FLOPPY DISC CONTROLLER	Model 2422A	\$359
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APPLE JOYSTICK	\$ 49.00
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CIRCLE 60

quences. Fields, sub-fields or columns can be sorted in either ascending, or descending order. Numeric fields containing embedded characters such as decimals, commas and plus or minus signs are logically aligned. Sorted files may be as large as the available disk capacity.

Other features of the OASIS operating system include: single and multi-user versions for up to 16 operators; flexibility in maintaining public, private or shared files with security and accounting controls; a BASIC compiler and interpreter; inter-user communications; a general purpose text editor; and program development tools.

Available from microcomputer dealers worldwide, cost for the new File Sort Option and manual is \$100. For more information contact Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA 94621; (415) 562-8085. *Circle No. 117*

Master Catalog

A Master Catalog system that can keep track of all the files on all diskettes in use, is available on single density 8 inch and 5¼ inch diskettes for users of Digital Research's CP/M.

The system produces a listing of file names, in alphabetic order, with the name of the disk containing that file. Selective listings may also be made in a manner similar to that used by the CP/M "DIR" command. The "SUBMIT" command may be used to list the directories of selected diskettes.

In addition to the Master Catalog system, the diskette contains a program that sorts the directory on a diskette in alphabetic order and gets rid of non-ERA'able files. Also included are directory listing programs that list the directory in alphabetic order, three or four columns wide, with the file size. One program handles double density disks.

Both source and object programs and instructions are includ-

ed on the diskette for \$10 plus \$1.50 for shipping & handling. For more information contact Elliam Associates, 24000 Bessemer St., Woodland Hills, CA 91367.

Circle No. 118

SYSTEM

CBASIC Runs Under UNIX

Compiler Systems, Inc. has announced the release of CBASIC/16 for microcomputer-based systems running under UNIX, and other operating systems supporting the C language.

CBASIC/16's initial installation is on the Onyx Systems C8002 microcomputer, running under ONIX, Onyx's version of Western Electric's UNIX operating systems.

CBASIC has already been adapted for use on systems supporting CP/M, MP/M and TRSDOS, and by the end of 1981, the fully transportable language will be available for 8086 and CP/M-86 based systems as well, the company said.

Suggested retail price is \$250. For more information on CBASIC/16, contact Compiler Systems, Inc., P.O. Box 145, Sierra Madre, CA 91024; (213) 355-1063. *Circle No. 119*

Oasis for North Star

Providing single or true multi-user capabilities with enhanced file management and software development facilities, the Oasis operating system is now available for the S-100 based North Star Horizon microcomputer.

The Oasis/North Star combination allows unique flexibility in maintaining public, private or shared files with versatile user security and accounting controls. Oasis file locking and automatic record locking insure data integrity for up to 16 users.

Supporting the new North Star 18 Mbyte Winchester-type hard disk, Oasis compliments the mass

storage media with sophisticated Archive and Restore back-up capabilities, the company said.

Comprehensive program development support offered by the new Oasis/North Star system includes re-entrant high level BASIC, EXEC interactive job control language, text editors, compiler, interpreter, relocating macro assembler, debugger, linkage editor, and diagnostic/conversion programs. File sort and RM COBOL (ANSI '74) are optionally available.

Available from North Star dealers worldwide, suggested US retail price for the OASIS option is \$500 for single-user and \$850 for multi-user versions. For more information contact Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA 94621; (415) 562-8085. *Circle No. 120*

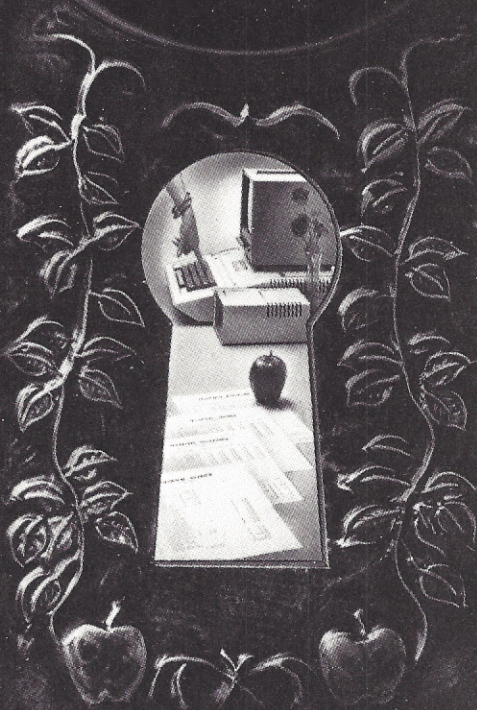
PL/I Language

Westico, The Software Express Service, announces the availability of PL/I-80 from Digital Research, the world's first all-purpose application programming language for 8080, Z80 and 8085 microprocessors.

PL/I-80 programming systems comprise four major components: PL/I-80 compiler, LINK-80 linkage editor, PL/I-80 run time library and RMAC relocatable macro assembler. The system generates industry standard Microsoft relocatable code so users can link load subroutines created by other language translators. LINK-80, a disk to disk link loader, can load programs up to the maximum size of the machine. The run time library contains over 300 individual subroutines but load only those which are used by your program. An executable program can be as small as 600 bytes.

PL/I-80 software and documentation cost \$500. Documentation alone is \$35. For more information contact Westico, Inc., 25 Van Zant St., Norwalk, CT 06855; (203) 853-6880. *Circle No. 121*

It's Almost Obscene...



The tricks our IBMS software can make your Apple* do!

The small businessman has never had it so good, or so easy. Because now there's our **Interactive Business Management System (IBMS)**... which lets your micro-computer perform like a larger unit, so you can mind, monitor and manage every aspect of your business accounting.

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Save Maximum Time

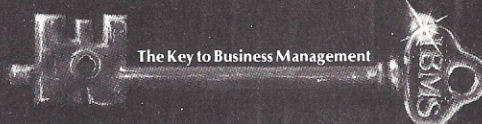
Since IBMS is a totally interactive system, multiple-entering of data is eliminated. Make an entry in one area and it automatically updates all concerned areas! No duplication of effort, no wasted time, no problems.

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It took 3 years to develop IBMS, including shake-down and on-site testing. As a result, it's reliable and versatile and its documentation is thorough and easily understandable. No wonder we consider it 5 years ahead of anything else available to the Apple II user.

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The complete IBMS software package, on mini-floppy disks, documentation, and the backing of Programma International, Inc. is offered for a limited time at the **Introductory Price of \$1495.00**. You'll be amazed how it can satisfy you... by saving you time, effort, money and employee growth.



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Operating Systems

continued from page 87

and implemented on the UNIX operating system by Dennis Ritchie. In fact, UNIX is written in C. While it is true that other languages, such as FORTRAN, Pascal, LISP, APL and even BASIC also run under UNIX, C seems to be the logical choice. It also runs on many non-UNIX systems and on programs that do not include the UNIX-only features, such as pipes. These programs are transportable to other machines.

Since the advent of multi-user microcomputers with ability to support large blocks of memory, many systems designers have dreamed of being able to run under UNIX. However, the licensing fees and restrictions imposed by Western Electric, which controls the distribution of UNIX, have discouraged microcomputer companies. As a result, some companies sought to design UNIX look-alikes.

The OS-1 look-alike. . .

One Unix-like operating system for the Z-80 is OS-1 by Electrolabs of Stanford, CA. It is compatible with CP/M and CDOS (Cromemco) and claims to have many of the features of the original system, including virtual I/O, pipes, shell and multi-user capability. With all these features, it runs in only 12 kilobytes of memory and supports a C-compiler, FORTRAN and BASIC.

. . . Or try UniFLEX

UniFLEX by Technical Systems Consultants is a UNIX-like system designed for 6809 and 68000 microprocessor-based computers. It is a multi-user, multi-task system, with many of the advanced features found on the original. It includes a Text Editor, assembler, and about 40 utilities.

UniFLEX supports a native C-compiler, Pascal and BASIC. A text processing system, sort/merge and business applications are under de-

velopment. Technical Systems Consultants developed the FLEX operating system for the 6800, a standard for many 6800-based micros.

XENIX, the McCoy

Microsoft has taken another tack. It has obtained a license from Western Electric for the UNIX system and has adapted it for its new 16-bit micros under the name XENIX. This is a true UNIX system for smaller computers, and it promises to become a contender for the "standard" system for the next generation of microcomputers. Microsoft hopes to solve the high license fee problem by absorbing the largest part of the fee for small-quantity sales and then advancing rapidly to large-volume sales and a higher markup.

The OS-9 multiprogrammer

The OS-9 system from the Micro-ware Systems Corp. is another UNIX-like system for M6809-based computers. It is a multi-tasking, real-time operating system that can be used for time-sharing and data base applications. It has a UNIX-like file structure with hierarchical directories, as well as random-access files with full file security. It has a shell command interpreter that features I/O redirection, multiple-job processing and a full set of utilities. The OS-9 LEVEL 2 includes hardware memory management that can address 1 megabyte of RAM, and it includes pipes and interprocess data transfers. The OS-9 LEVEL 1 is a simpler version that runs on systems without memory management in 56 kilobytes of RAM.

Exploring new vistas

The newest multi-user operating systems—MP/M, OASIS and UniFLEX—can take the microcomputer out of the range of personal computing and into that of big business. And why not? Matson Shipping Lines has a North Star Horizon

aboard each of its ships. The Du-rametall Corp. has two Apple IIs sitting beside its IBM System 3. Alaska's Educational Telecommunications Project has placed microcomputers in each school district office.

Mult-user systems permit each user to share the resources of a geographically distributed system. One user may run several programs, or several users may run the same program simultaneously. The multi-user operating system must allow users access to the files of one another, and it must intervene to ensure that such access is nondestructive. Multi-user operating systems must provide all the basic functions of a one-user system plus allocations of resources, memory management, multi-programming and security.

A desirable feature of both OASIS, made by Phase One Systems for Z-80-based processors, and UniFLEX, designed for 6800 and 68000-based processors, is that they accomplish all of these pluses while remaining perfectly understandable for the average user. In fact, both are considered to be as comprehensive, and easier to understand, than the operating systems of certain \$500,000 computers. MP/M from Digital Research is less comprehensive and harder to understand, but it does represent a compatible upgrade for CP/M users.

To buy or not to buy

Should you make do with the operating system supplied by the manufacturer? Not always. The cost of an improved system or of system enhancement is relatively low. CP/M costs \$170 for the TRS-80, Model II, while the gains in productivity are almost unlimited. The purchase of an Apple II Softcard with CP/M (about \$350) gives you access to about three times as much software. □

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gram should present no problems; you simply follow the excellent manual provided with the package.

After "saving" a BASIC program in ASCII format, you initiate compilation by running one of the programs on diskette No. 1. The program checks for compiler syntax errors. At this point you are compiling the program, but you are not creating a file for the compiled code; rather, you are directing the compiler to display error messages on the video display screen.

After the Microsoft program runs for a few minutes, it indicates those lines in the BASIC program that contain nonfatal and fatal errors. If the BASIC program has fatal errors, which are identified with a two-letter code that you can look up in the manual, you go back to the BASIC program, correct the errors and resave it.

Storage on a disk

Once all the errors are out of a program, you load the compiler program into memory, and it compiles the source program into object code. The object code is stored on a disk, and at the same time a listing file is also saved on the disk.

The listing file can be viewed on the video screen or printed out (below). Either way, each line of the source program is listed followed by the code generated for that line. The code includes calls to machine language subroutines in the runtime library, as well as assembly language operations.

Although a listing file might be beneficial to someone with assembly language programming ability, it can present problems if you generate one each time you compile a BASIC program. Because it contains both source and object code, a listing file is enormous and rapidly fills the available space on a diskette. Even a formatted diskette

with no user programs on it oftentimes fills to capacity. To avoid this problem, suppress the generation of the listing file.

The next step in the process is to insert the second diskette of the Microsoft package and use the link loader, which takes relocatable object code file produced by the compiler, loads that file into memory, and converts the file into executable object code. The file produced by the link loader can then be run. The machine language versions of BASIC programs can run anywhere from two to 32 times faster than their BASIC counterparts.

Although the process may seem complicated, the manual makes it easy to follow, and even a relative novice should be able to compile programs with little trouble. In addition the manual provides detailed information that will make the compiler's use extremely flexible for sophisticated programmers.

BASIC Apple Compiler

A compiler for an Apple II computer with Applesoft and at least one disk drive is under development at the Hayden Book Co. and should be released by the time you read this report. Like the Microsoft Compiler for the TRS-80, the Apple compiler is user-oriented and very easy to use. A command from the computer's operating system loads the compiler program into memory, and a menu takes you through the process of setting up parameters for the system. If you have no special requirements, such as use of the high-resolution memory area for the BASIC program you want to compile, hitting the RETURN key sets up default values. From that point on, the switching of diskettes is directed from prompts on the video display; you simply follow the prompts, which take you completely through the process of compilation.

The Apple compiler makes 17 passes through the BASIC program with a speed equal to a four-pass compiler for the TRS-80. At the end of compilation, the compiler provides a detailed analysis of the structure of the compiled BASIC program by showing the address ranges of literals, constants, main program code, object modules, scalar space and the string pool.

Of the compilers examined, the Apple compiler may be the most user-oriented, in that you don't even need documentation to tell you how to compile a BASIC program. The documentation that will be supplied was not available at the time of this review, and no price had yet been set for the program.

Microsoft is developing a compiler for an Apple computer equipped with the Apple Softcard Z80 emulator. The new product is a revision of Microsoft's standard CP/M compiler, contains Apple features such as high resolution graphics and sound. Of the special Apple features, the only one requiring special operation is the high resolution graphics. At this time, no provisions have been made for the Link Loader to automatically reserve

```

** 008F'      DW      Q!
** 0091' I00001:
0091 002E      23 K=48: IFQ<KTHEN22
** 0091' L00023: CALL   $FASA
** 0094'      DW      K!
** 0096'      DW      <CONST>
** 0098'      CALL   $LTJA
** 009B'      DW      Q!
** 009D'      DW      K!
** 009F'      DW      L00022
00A1 0032      24 K=58: IFQ>KTHEN22
** 00A1' L00024: CALL   $FASA
** 00A4'      DW      K!
** 00A6'      DW      <CONST>
** 00A8'      CALL   $GTJA
** 00AB'      DW      Q!
** 00AD'      DW      K!
** 00AF'      DW      L00022
00B1 0032      26 K=47: Q=Q-K: K=150: L=0: M=0: O=Q-X
** 00B1' L00026: CALL   $FASA
** 00B4'      DW      K!
** 00B6'      DW      <CONST>
** 00B8'      CALL   $BSUA
** 00BB'      DW      Q!
** 00BD'      DW      K!
** 00BF'      CALL   $FASO
** 00C2'      DW      Q!
** 00C4'      CAL

```

Microsoft's BASIC Compiler generates a listing file that contains both the source code of your BASIC program and the assembly-language operations of the compiled version.

continued on page 112

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The **MICROCOMPUTER REFERENCE HANDBOOK** reviews in detail more than 130 microcomputer systems from over 50 major microcomputer suppliers, including some of the latest Japanese manufacturers. It is designed to aid both first time and experienced computer users in choosing a single-board microcomputer or microcomputer system to suit their application. It is presented in four parts.

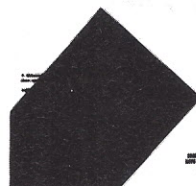
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the 8K of memory that the high resolution graphics require. Through the use of a software switch, however, you can have the loader set a default address for the loader to the memory just above the hi-res graphics area.

Although the Apple compiler is still in the testing stage, Microsoft's past performance and the quality of its software in general make the new compiler worth looking at as soon as it is released. No release date or price has been announced for the product.

Compiler Systems, Inc., recently announced that CBASIC 2.07, the company's newest release of its compiler BASIC, is now available for the TRS-80 Model II computer running under TRSDOS. The TRSDOS implementation of the package is designed to provide users with the same features as CP/M including files supporting unlimited record lengths, dynamic allocation of arrays and full format control of printed records. CBASIC 2.07 is available on a TRSDOS disk with a text editor from Lifeboat Associates at a retail price of \$250.

Take your pick

As you can see, the relatively limited memory available on a personal computer like the TRS-80 results in compiler programs that are implemented in different ways. The best compiler for you will depend on what you want to achieve, the specifications of the personal com-

puter you have, your programming ability and the amount of money that you think a compiler is worth to you.

If you're looking for a good general-purpose compiler and you don't mind spending a considerable sum, the Microsoft package is probably your best bet. It's easy to use, efficient, flexible and well-documented. Microsoft is writing a new version of the compiler that is supposed to work even more efficiently within the memory limitations of the TRS-80.

At the same time the ACCEL compilers offer good general-purpose compilation for a lot less money. The compiled programs aren't as efficient as they would be under Microsoft, but they offer a great deal of flexibility for the money. If you don't have disk drives on your computer and want to economize, the ACCEL programs are an excellent buy.

For persons who wish to compile integer math programs for use in control, games, sorts, music and scientific applications, Simutek's ZBASIC makes the process of compiling easy with its menu-driven setup. But some programming expertise is needed if you want to emulate programming statements not directly supported by this package.

Tiny Comp is much more limited in its abilities than any of the other packages, but it is also the cheapest. If you are interested in learning how to generate machine language using BASIC programming statements, Tiny Comp will help you master the techniques.

The Apple compiler seems to offer as many benefits as Microsoft's TRS-80 compiler and has the advantage of a complete user orientation, with prompts guiding use of the system at each step.

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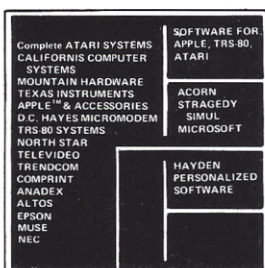
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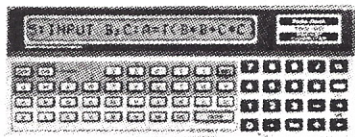
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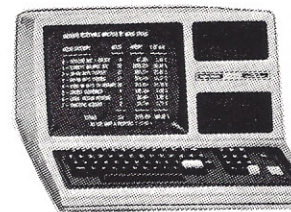
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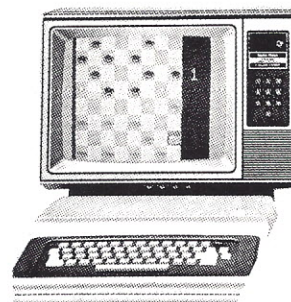
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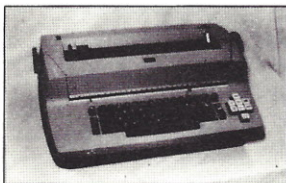
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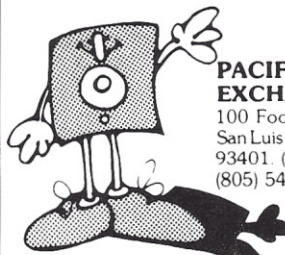
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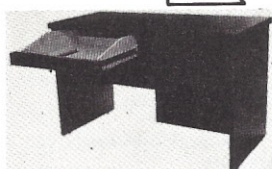
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Going faster with Faster

continued from page 112

Faster, a machine-language utility program from Prosoft for TRS-80s, helps you speed up BASIC programs by showing you how to modify the programs to obtain maximum effectiveness. The TRS-80s interpreter searches a table each time a variable is referenced in a program.

Because this search always starts at the beginning of the table and continues until the variable is found, the variables used most often during execution should be placed at the beginning of the table, to keep the search time as short as possible. Prosoft, realizing that the average computer user would be unable to determine the frequency of execution for variables, has come up with a utility program to make the job simple.

The Faster program counts the

variable references for you and displays on a video screen or printer the variables in descending order of use. By following the step-by-step instructions in Faster's documentation, you rearrange the variable placement within the BASIC program, so that the variable table used by the computer is optimized. After rearranging the variables (and the DIM statements), you "resave" the BASIC program. Once you've optimized a program, you run it just as you did before, only it runs faster.

To use Faster, you activate it through the Disk Operating System. Once activated, Faster leaves you in BASIC. You then load and run the BASIC program you want to speed up. It isn't even necessary to run the BASIC program to completion; just run it long enough to ensure that a

representative sample of its activity takes place.

When you feel the BASIC program has run long enough, you activate Faster's Option Selection Mode by simultaneously pressing three keys. The BASIC program ceases operation, and Faster's menu appears at the bottom of the screen. The menu enables you to: reset the counters; exit the option mode; get a summary of the variables; get a detailed analysis of the variables; print to the video display; or print the analysis to hard copy.

Faster is available on tape or disk for any 16, 32 or 48K Model I or Model III tape or disk system. One physical copy of the program understands any of the system variations. Faster is effective and easy to use. It sells for \$29.95. □

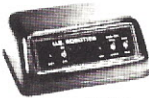
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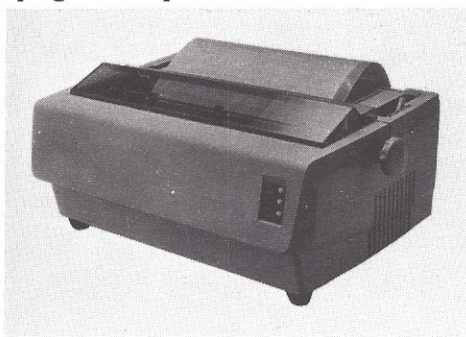
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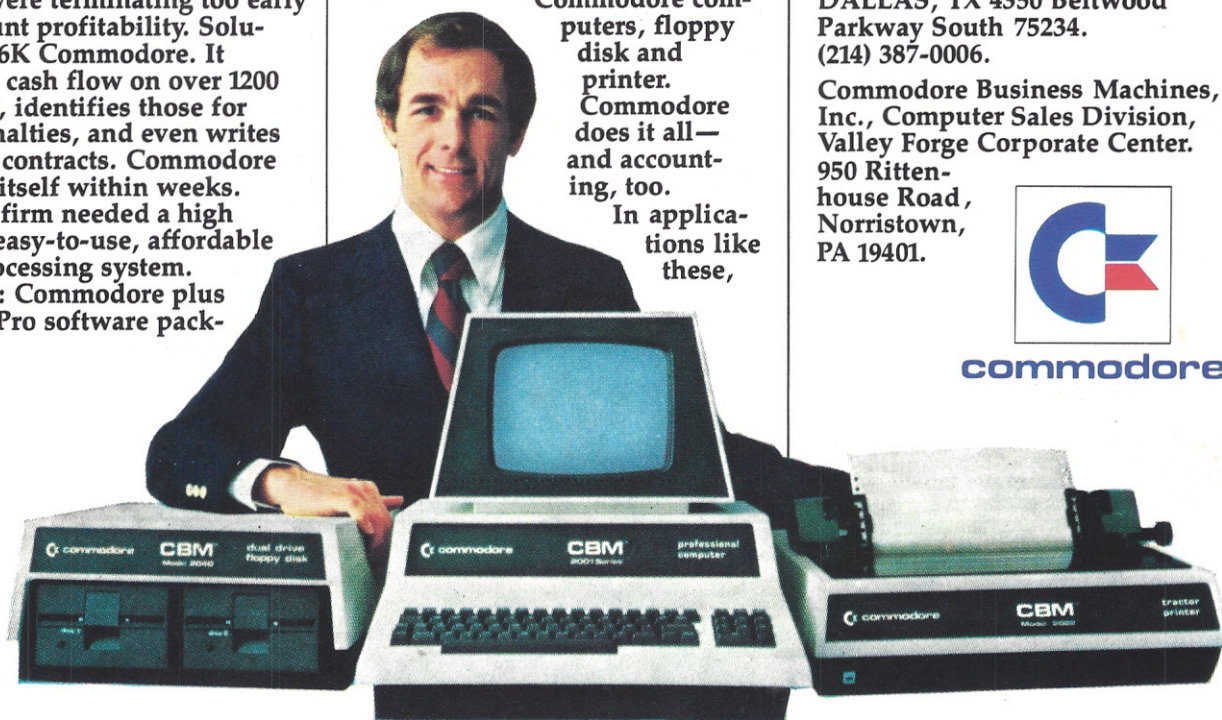
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